THE

ELECTRICAL REVIEW.

VOL. LX. MAY 3, 1907. No. 1,536.

ELECTRICAL REVIEW.

Vol. LX.] CONTENTS: May 3, 1907. [No. 1,536.

	Page
The Engineering Trades Agreement	705
The Colossus of Roads	706
The Amendment of the Patent Laws	707
Copper	707
Publicity: Another Point of View (*continued*)	708
Correspondence:—	
Income-Tax and Depreciation	709
Of Dogmatism in Science	709
Braking Operations for Tramcars	709
Fancy Names for Lamps	710
Lynch *v.* Macartney, McElroy & Co.	710
Station Engineers and Contractors	710
Dust and the Electric Light	711
Growth of Battery Plates	711
Parliamentary	711
Legal Query Column	714
Legal	718
The London Power Problem	718
Business Notes	719
Electric Power in Durham Collieries (*illus.*) (*concluded*)	725
Triple Motor-Generators, Hamburg Metropolitan and Suburban Railway (*illus.*)	728
Notes	730
City Notes	734
Market Quotations	738
Stocks and Shares	738
Share List of Electrical Companies	739
Metal Market.—Fluctuations in April, 1907	741
New Electrical Devices, Fittings, and Plant (*illus.*)	741
Proceedings of Institutions:—	
Electric Wave Propagation (*illus.*) (*continued*)	743
Depreciation	744
Another New Apprenticeship System	746
New Patents Applied For	747
Expiring Patents	748
Published Specifications	748

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THE

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(J. A. BERLY'S).

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THE ENGINEERING TRADES AGREEMENT.

FOR nine years there has been an unbroken peace in this country between the Engineering Employers and their employés; a peace due to the loyal observance of the "Terms of Settlement" arrived at in the beginning of 1898 after the longest, bitterest, most widespread, and most momentous struggle in the annals of British Industrialism.

For many years before the great engineers' strike there had been intermittent strikes of shorter duration; some for higher wages; some to resist reductions in wages; some because the men in one branch of trade were doing work which another section claimed as its monopoly; some as a protest against the employment of non-union workmen; others for shorter hours, and so on.

These were the skirmishes in which the forces of the Amalgamated Society of Engineers tested the strength of their common enemy—the Engineering Employers. During these years the British manufacturer had felt more and more the increasing intensity of American and German competition, due largely to the cheaper methods of production in those countries, consequent upon the more general use of labour-saving machine tools and the changed conditions of workshop practice which these modern appliances produced.

When British manufacturers at length awoke to the facts, and began to import American and German machine tools, and to re-model their shops on competitive lines, the storm burst. The English Trade Unions tried to dictate to the engineering masters the methods upon which their works should be conducted, the fundamental idea being the limitation of the amount of work to be performed by each workman. One man one machine, and one machine one tool; five workmen to one apprentice; an eight-hour day; no overtime; no piecework; no bonus or premium system; no hustling; and "ca' canny"—these were to be the conditions of the ideal shop.

For a start, the 48-hour week was demanded, and on this being refused—as was expected—war was declared, some 80,000 men being eventually numbered among the ranks of the strikers. But the unexpected happened. Instead of individual works being, one by one, forced to surrender, the masters took a leaf out of the men's book, and themselves formed a Trade Union—the strongest in numbers, and most powerful in influence, of any organisation of employers ever known. Some employers did not at first take kindly to the idea of federation, and held aloof; but pressure was brought to bear upon them, and by methods of "peaceful persuasion," very soon every firm of importance, except a few such as Tangye's and other members of the Society of Friends, who entertain conscientious objections to fighting, were brought within the fold.

After a seven months' battle, during which it was estimated that the men lost upwards of £3,000,000 in wages, the men recognised that they *were* the men and not the

masters, and returned to work under conditions known as the "Terms of Settlement," but sometimes referred to as "The Employers' Charter."

These terms were really the terms insisted upon by the Employers' Federation, and eventually accepted by the men's representatives. Some of the more militant spirits have always chafed under the new conditions, and have been biding their time until they considered the trade unions would be in a position to re-open the questions and demand more favourable terms. Before the last Trade Union Congress there was a great deal of talk in this strain, and it is, therefore, very satisfactory to note, as we do from the *Times* Financial and Commercial Supplement of last Monday, that the new "agreement between the Engineering Employers' Federation and Engineering Trade Unions as to working conditions and avoidance of disputes," which has just been signed by the representatives of both parties, formally ratifies, with little modification, the original terms of settlement.

The *Times* correspondent considers this new agreement to be the most comprehensive and fair-minded document ever evolved, and interprets many of the clauses as great concessions. A comparison of the new agreement with the old terms of settlement does not appear to bear out this idea, and we should not be serving the true interests of the workmen by misleading them into supposing that any alteration in the spirit of the original terms of settlement had been made. The alterations, where they occur, are such as to make the terms read as a mutual arrangement rather than demands made by one party and accepted by another. Thus, whereas the introductory note to the original terms reads :—"The Federated Employers, whilst disavowing any intention of interfering with the proper functions of Trade Unions, will admit no interference with the management of their business," the new clause reads :—"The Federated Employers shall not interfere with the proper functions of the Trade Unions, and the Trade Unions shall not interfere with the employers in the management of their business."

This, it will be noted, is a mutual undertaking, and this note of mutuality is the dominant one throughout.

The freedom of the federated employers to employ any workman, whether he be a Trade Unionist or not, is preserved in the new arrangement, but whereas in the old terms "the Federation do not advise their members to object to union workmen or to give preference to non-union workmen," we have in the new agreement a more liberal and broad-minded understanding, by which "the Trade Unions recommend all their members not to object to work with non-union workmen, and the Federation recommend all their members not to object to employ workmen on the ground that they are members of a trade union."

Perhaps the greatest concession to Trade Unionism is the final sentence in the clause relating to the Constitution of Conferences, which is to the effect that an employer who refuses to employ Trade Unionists will not be eligible to sit in Trade Conferences. By this clause the status and functions of Trade Unions receive full recognition.

On the subject of piece-work and overtime, the old terms gave the Federation the right to continue and to extend the piece-work system, and to arrange prices with the men. The *Times* correspondent says that "the Trade Unions have secured from the Federated Employers the concession that no man on piece-work and at the piece-work rates, shall earn less than the day's rate he would earn if he were working on time wages." This does not strike us as a great concession, because according to the old terms the clause reads, "the Federation will not countenance any piece-work conditions which will not allow a workman of average efficiency to earn at least a wage at which he is rated."

As regards the question of overtime, however, the terms have been somewhat modified. It obviously does not suit employers to pay overtime rates, and they only do so when forced by exceptional circumstances. According to the 1898 terms, the Federated Employers recommended that no man should be required to work more than 40 hours' overtime in any four weeks after full shop hours have been worked. This, in the new agreement, has been reduced to 32 hours—a modification which scarcely justifies the *Times* correspondent saying "the Trade Unions have now persuaded the Federated Employers to agree to discourage overtime," seeing that, in the old rule, it was the Federated Employers themselves who definitely recommended the restriction of overtime.

On the subject of apprentices, however, there is a distinct modification of the old terms, in which the Federated Employers resolutely declined to agree to any modification as to the number of apprentices. According to the new agreement, whilst the clause reads that there shall be no recognised proportion of apprentices to journeymen, it leaves it open to the unionists to bring forward for discussion the proportion of apprentices generally employed in the whole federated area. Further than this, the clause provides that "an apprentice shall be afforded facilities for acquiring a practical knowledge of the branch of trade he adopts, and shall be encouraged to obtain a theoretical knowledge thereof as far as circumstances permit."

The question of apprenticeship is one that has been very much to the fore during the past few years. It has been recognised that, under the modern conditions of workshop practice, the old seven years' system of apprenticeship is an effete system, and many proposals have been put forward for consideration and some put into practice, having for their object the curtailment of the actual time spent in the works, and increased facilities for the prosecution of technical studies.

In another part of this issue a contributor deals with "Another New Apprenticeship System," in which it is pointed out, and we think rightly pointed out, that the proposals for improving the position of the apprentice have almost invariably been brought forward by the masters' and not by the men's representatives. We need not further amplify this point here. We might, however, remark that just as the changed conditions in workshop management and modern methods of manufacture have materially affected the position of the artisan, splitting up a trade into several specialised sections, and giving increased opportunities of advancement to technically-trained apprentices, so also has the relation between master and man undergone considerable change. Under primitive conditions, where a manufacturer made necessary commodities for other members of the community, there was a greater community of interests than is possible under present conditions of life; whereas formerly a manufacturer existed for the convenience of his fellows, and when it might be said that the consumers provided the work for the manufacturer, it is, perhaps, more true nowadays to say, notwithstanding Socialistic arguments to the contrary, that the manufacturer is in a position, by opening up new branches of industry, to provide work for the working-class population. We do not for a moment argue that this is an ideal state of things, but we are bound to recognise things as they are, and not as they might be under so-called ideal conditions, as understood by a Communist.

We hope, therefore, and firmly believe, that the new agreement which has been brought into existence is one that will make for peace in the engineering industry for years to come. The enemies of peaceful relations between master and man are professional agitators who seek to gain a cheap notoriety, and the irresponsible Press.

The Colossus of Roads.

It is some time since the Government, through either the Post Office or the B. of T., forced us to protest against the way in which tramway undertakers are compelled to protect the property of the P.M.G. at their own grievous cost, but we have to fly to arms again at the bugle call of the Municipal Tramways Association, whose outposts have come into touch with the enemy advancing under cover of darkness.

The Corporations of Manchester, Glasgow and Sheffield are promoting Bills this year, and into them the Post Office desires to put clauses which will enable it to use any posts, standards, or brackets erected in any street or public road, and to lengthen or adapt those poles and brackets as may be required from time to time.

The Postmaster-General graciously agrees to give 14 days' notice of his intention to use any pole, and even to pay for adapting it to his purpose, but the Municipal Tramways Association is not at all mollified by this display of magnanimity, and wants to know why such an innovation should be made without due discussion of its rights and wrongs. Very rightly, in our humble opinion, the deputation representing between 50 and 60 municipal tramways, which waited on the Postmaster-General on April 22nd, pointed out in polite, but forcible, terms, how improper it was of the Post Office to submit these clauses so late in the Session direct to the Parliamentary Agents who are drafting the Bills, instead of bringing them first before the notice of the Municipalities, for once passed in the Manchester, Sheffield, and Glasgow Bills, the clauses would be added to the model clauses which are incorporated in all new Acts.

We do not understand how the advisers of the Post Office can have allowed such a stupid blunder to be made, for it is nothing else.

Knowing how sore the whole tramway community remains while the guard-wire regulations are in force, together with other inflictions which have been imposed with the idea that no one has a right to the street except the Post Office, it was quite childish to suppose that further compulsory—almost confiscatory—clauses could be slipped in unnoticed, or with the timid acquiescence of the threatened interests.

The reasonable attitude which the Association has assumed, even in face of an unmannerly thrust, shows how much the Post Office might have done by open dealing, for it admits that a great deal may be done to reduce the number of poles in the streets, and would have been glad to discuss the best way to bring this about. Instead, the Post Office finds that it has roused a sleeping dog, and will have to defend itself against the old challenges of its authority for assuming the prior right to the roads, and for exacting performances and penalties from the wayfarers who happen to have appeared a little later.

The manifesto of the Association runs :—Sec. 12. The municipalities think that the time has arrived when the Post Office should recognise that tramways are constructed and used in the public service just as much as the telegraphs of the Postmaster-General, and the public have the right to expect that there should be some reasonable understanding with regard to the wires and apparatus of the respective undertakings, with the object of reducing the risk of accident to persons passing along the streets.

The Association shows, as we have shown often before, that the telegraph wires ought to be put underground ; and we are glad to think that a renewal of the agitation for this eminently sensible solution of the whole trouble has been precipitated by the unguarded and impolitic action of the Post Office officials themselves. It is quite time that they brought themselves down to the level of ordinary mortals, and went out to meet the tramways halfway, as the N.T.C. has done for several years, for they will gain nothing but hard blows if they persist in their present policy.

The Amendment of the Patent Laws.

Mr. B. H. Thwaite, in a paper entitled "The State and the Inventor," read before the Glasgow Technical College Scientific Society, discusses the defects of our present Patent Laws, and suggests certain amendments which, in his opinion, would bring them nearer to the ideal. Mr. Thwaite's suggested reforms either appear to be impracticable or are embodied in the Patents Bill at present before Parliament. Mr. Thwaite thinks that the life period of a patent should depend on its character. It does so under the present law, for if its character is bad the continuation fees are not paid, and its life period is short. In so far as Mr. Thwaite's remarks imply that the maximum period of 14 years should be extended in the case of valuable inventions involving the expenditure of much time and capital in their development, we agree that much greater prolongations should be granted than at present is the case, and that such extensions should be dealt with by a less expensive Court than the Privy Council. Mr. Lloyd-George, however, has expressed his willingness to amend his Patents Bill in this direction.

Mr. Thwaite considers that our Patent fees should be reduced much nearer to the American level ; but when we consider that a patent is granted in this country for an invention which would be split up into three or four patents in America, the difference in the fees is not so great as it looks.

One of Mr. Thwaite's impracticable proposals is that "the Patent Office should provide a department to advise on the question of infringement ; if given in the affirmative, then the advice should constitute *primâ facie* a case for the issue of an injunction, the charges for such advice being merely nominal." It may be asked why the State should pay for legal advice for the benefit of inventors in preference to any other class, say ships' captains. Moreover, important patent cases involving large sums of money could only be settled by regular courts with their trained lawyers and facilities for collecting and sifting evidence. The new Patents Bill proposes to do much to reduce the cost of legal proceedings in patent cases, by adding considerably to the judicial powers of the Comptroller, but even these amendments—small compared with Mr. Thwaite's revolutionary proposal—have encountered great opposition in the House of Commons and elsewhere.

The Patents Bill at present before Parliament, if passed, will remedy most of the real defects of our own present patent law. But the provision for the compulsory working of patents worked abroad appears to us to be an experiment of doubtful value, and can only be regarded as a protectionist measure which will in most cases increase the price of goods to the consumer, and will give little help to the manufacturers whom it is intended to relieve.

Mr. Lloyd-George has not had the courage to give the Patent Office the power to reject patents wanting in novelty, but the powers given to the Comptroller to revoke patents may, in the long run, have the same effect.

Copper.

Rather unfortunately for the genuine consumer, copper is steadily regaining the high price at which it was valued prior to the Easter slump. The ends of the four weeks in April (6th, 13th, 20th and 27th) saw the price respectively £95 5s., £94 15s., £99 10s. and £103. The month closed on a price of £103 5s. The price for three months' delivery, £102 5s., anticipates a continuance of these prices at least till the end of July, and with the exception of similar "raids" to that of a month ago, there appears little hope of a solid and steady reduction until after that month. By that time it will, however, be odd if the output does not begin to have some influence on the market. The idea that the demand will go on increasing ahead of the supply is hardly a sound deduction. The high prices of 1873 and 1889 were followed in the first case by the opening up of the Spanish industry, and in the second by the doubling of the United States output. The price was halved in the course of the period between the two "booms," and the same drop occurred midway between the second and the present one. Meanwhile, however, the mines benefit, and the consumer is squeezed.

The increase in the visible supplies for last month, coming upon a nervous market, caused heavy selling at the beginning of April, which was soon counteracted by investment on the part of those to whom cover was a necessity. Consumers were forced in during the latter part of the month, and easier conditions of money helped to restore steadiness.

The visible supplies for mid-month were 13,780 tons. The same date last year registered 9,533. Refined qualities are little affected by speculative fluctuations, and their prices give a better indication than standard of the state of the market from the point of view of the industries affected.

PUBLICITY: ANOTHER POINT OF VIEW.

[COMMUNICATED.]

(*Continued from page* 668.)

THE next subject to discuss is that of literature. The mailing list may take months to prepare, but in the meantime the literature should be systematised. First of all there are generally two broad classes into which it may be divided, namely, priced and unpriced. The first will consist of catalogues or price lists (*i.e.*, bound books of various thicknesses), and leaflets or price sheets (*i.e.*, not exceeding eight pages, and requiring no binding). These are determined by the nature and number of the goods that have to be listed. The second class will consist of descriptive articles or reading matter, called variously brochures, pamphlets, bulletins, &c. Priced publications should be drawn up on a more or less definite programme, depending on the nature of the goods manufactured and the classes into which they may be conveniently divided to suit different trades. Then arrangements must be made in advance for an efficient system of binding or filing the lists together, as, if something of the sort is not done, buyers will not trouble to keep a lot of loose publications. Descriptive publications, being occasional only, cannot be turned out to programme, but a cover or file should also be provided for these, in order that they may be collected and kept together. The size of the publications should be standardised first of all, as nothing is more worrying to buyers than to receive from one firm literature of different sizes. A series of type founts should also be selected and adhered to, specific and suitable types being allocated to descriptive matter, titles, prices, catalogue numbers, legends under illustrations, &c. Nothing looks better than uniformity, and this enables a firm's publications to be recognised at once. Again, a suitable make of paper should be selected, and, if possible, adhered to throughout; and it should be borne in mind that for the small extra price involved, a surface paper gives the better result. The illustrations also should be good, and of the same style throughout. That is, if wood engravings are used (and these are nearly out of date except for small articles where detail has to be shown), they should have a definite character, and not vary in brilliancy. Half-tone blocks should also be uniform, with equal screening, and the same amount of retouching (if necessary). In fact, it pays to employ one firm of engravers for block-making. Generally speaking, uniformity should be cultivated, and cheapness avoided. Nothing stamps a firm more than its literature. Cheap and nasty printing suggests to the buyer cheap and nasty goods, and fails to give tone. On the other hand, extravagance should be avoided. Technical publications do not require heavy art paper, highly retouched blocks (which suggest that the machines have never seen the shops) and tinted backgrounds. These all imply to the buyer that he has got to pay for the firm's printing in the price of the goods.

Having got our programme together and standardised the details of the publications, the next point to consider is the collecting of data for them. The initiative in the matter of producing literature should, in a live business, come from the commercial departments. These, having something to sell or to advertise by descriptive brochures, should advise the Publicity Department to take up the preparation of literature as may be required. More often than not, however, the manager may find that a selling department is not ahead sufficiently, and when the goods are on the market, there is then no literature ready. He has, therefore, to watch those departments closely, and often take the initiative himself. In some firms the Publicity Department is automatically fed with technical letters from the engineering and commercial sections, but generally the information has to be dragged out by frequent journeys and personal interviews, as letters on such "unimportant" subjects are often not attended to, owing to pressure of work in connection with customers' orders. In any case, it is always advisable to confirm all interviews and reduce everything ultimately to writing in order that a record may be kept. Having obtained the necessary data, the "copy" is put together and estimates are obtained. The manager will find that he is worried by two circumstances—firstly, printers' travellers are continually calling, and cannot, of course, all get work. Secondly, certain officials in the firm will have friends in the printing trade, and ask for orders to be placed with these people. The printing work should, if possible, be confined to those firms who have a contra account, consistent with their work being good. It is advisable not to support more than half-a-dozen printers, as it is better to have a few who get used to your style rather than many who will always require teaching. It is advisable also to give work to those firms whose representatives give attention to the orders, and are polite and obliging. Always remember that good work cannot be got by squeezing prices. Either the work is scamped, or else the printers put on 5 per cent. extra when they get to know their man. When proofs come in they cannot be too carefully checked, not only against the "copy," but against the original data. A duplicate should also be sent to the respective selling department after all typographical errors, &c., have been corrected, and all such duplicates, &c., should be carefully docketted. It is always advisable to ask the printer for further proofs until all the errors have been corrected, and then to get an authorisation from the responsible department to proceed to print. The number of copies printed is, of course, determined by the firm's requirements, but it is recommended to arrange with the printers for keeping the type standing rather than to order too much stock. Literature rapidly becomes obsolete, when it is of no value whatever.

Finally, it is as well to examine printers' invoices carefully, and if possible to obtain an estimate for correcting proofs. It often occurs that a printer who finds that he has under-estimated the cost of composition will try to "stick it on" in author's corrections.

Having got in our stock of a publication, the next proceeding is to see that it is properly distributed. Firstly, copies should be sent to all those officials and clerks in the firm who will require to use it, and for this purpose a private mailing list may be kept. Then a small stock may be sent to each agent or branch for casual inquiries. It will be assumed that it has been arranged with the selling departments which class of people are to have the publication, and that envelopes have already been addressed for this purpose, and, if necessary, type-written letters duplicated. The envelopes should preferably be large, so that the publication can be sent flat, whilst the letters should be facsimile ones. Nothing is more annoying than to receive folded or rolled catalogues that have to be straightened out for filing purposes. On the other hand, the recipient pays more attention to the delivery if he gets what appears to be a personal letter accompanying the publication.

Every priced publication should have a discount slip attached; buyers will not trouble about literature containing gross prices only. If the Publicity Department is a large one, it may pay to keep a staff of addressing, pasting and inserting clerks. If not, the work is done very cheaply by casual employment of clerks from addressing agencies. In any case, it is advisable to keep a stock of addressed envelopes, properly pigeon-holed, for each class in the mailing list, and this stock must, of course, always be kept up to date. As soon, therefore, as a publication comes in from the printer, it can be inserted and despatched. Sometimes, however, it may be economical to despatch several publications together—that is, if they are going to the same class of buyers. This saves expense in postage and addressing, &c. The method of despatch should be arranged beforehand, after ascertaining the weight of each packet by making up a dummy. Then comparative estimates can be obtained from the various carriers and the Post Office. If the packets go by post, it saves time and labour to have them franked. Each envelope should have the address of the head office, or of the corresponding branch office, printed on, so that in case of removal, &c., this fact may become known by the return of the packet. When making a bulk despatch of this sort, all the branches or agencies should be advised of the contents, and the classes of buyers to whom they have been sent, so that they may follow the matter up promptly. When returns are received owing to deaths, removals or liquidations, the mailing list must be corrected, and the nearest branch advised. All that

now remains to be done is to endorse the mailing cards with the date and nature of publications dispatched in the manner already described.

(*To be continued.*)

CORRESPONDENCE.

Letters received by us after **5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

Income-Tax and Depreciation.

When my company were making up their annual accounts, we allowed for depreciation 5 per cent. on electrical generating plant, mains, &c., and 10 per cent. on consumers' meters. The income-tax assessor reduced this to 2½ per cent. and 5 per cent. respectively. The writer would be pleased to know if there is any definite schedule of allowances for depreciation drawn up for income-tax purposes, or do such allowances vary with the discretion of each assessor?

Secretary.

Of Dogmatism in Science.

Possibly I may be of some assistance to your contributor, "W. M. M.," if I furnish the quotation which he is unable for the moment to verify. It has not been added by Maxwell's editors, who have confined their additions to footnotes. In the quotation, v is the ratio of the electromagnetic to the electrostatic unit of electricity (§771) its value being approximately 3×10^{10}, whilst V is the velocity of propagation of the electromagnetic wave shown to be equal to $1/\sqrt{\mu K}$:—

"If the medium is air and we adopt the electrostatic system of measurement, $K = 1$ and $\mu = 1/v^2$, so that $V = v$, or the velocity of propagation is numerically equal to the number of electrostatic units of electricity in one electromagnetic unit. If we adopt the electro-magnetic system, $K = 1/v^2$ and $\mu = 1$, so that the equation $V = v$ is still true."

I must repeat that the error is entirely your contributor's. The definition $K = 1$ for air applies only to the electrostatic system of units, whilst $\mu = 1$ for air applies only to the electromagnetic system.

I know no more about Prof. Rücker's work than "W. M. M." has furnished, but if, as I surmise, he ascribes the inconsistency between the dimensions of corresponding units in the electromagnetic and electrostatic systems to the fact that the dimensions of μ and K are unknown, he has presented a point of view which is perfectly legitimate.

If I had not a suspicion that "W. M. M." is indulging his taste for raillery at the expense of your readers, and intends the whole affair as a joke, I would venture to hazard the opinion that he is merely out of his depth.

F. W. Carter.

Rugby, *April 27th*, 1907.

The question between Mr. Carter and myself is simply one of definition. I allow that the equation $D = \frac{E}{4\pi}$ for air, becomes, when electromagnetic units are substituted, $D = \frac{E}{4\pi v^2}$; and, *mutatis mutandis*, a similar factor occurs in the equation $B = \mu H$ when put into electrostatic units. What I object to is the mixing up this factor $1/v^2$ with μ or K.

The equation $D = \frac{E}{4\pi}$, put into words, means that the tension of a line of force at any point in an electrostatic field is numerically equal to the density of the lines of force at that point. The 4π occurs because there are 4π lines of force attached to a unit of quantity. In another medium E is less for the same density; *i.e.*, the tension per line is less, and the factor K is introduced to give the numerical relation between density of field and force.

Now, if a change be made to electromagnetic units, the unit quantity is v times as great, and the unit field must be diminished in the ratio $1 : v$, so that the force of unit field on unit quantity may still be one dyne. Therefore, there are now $4\pi v^2$ of the new lines of force attached to the unit of quantity, and the tension of each is consequently $\frac{E}{4\pi v^2}$. K, then, would have exactly the same meaning as before on changing the medium, and we should have $D = K \frac{E}{4\pi v^2}$.

Naturally, if anyone chooses to *define* K as the ratio of D to E, $1/v^2$ becomes a factor of K, as also does $1/4\pi$. I see no reason that can be assigned for including the one which does not apply to the other; and I object to the inclusion of either, first because it involves a change in the definition of the specific inductive capacity, and secondly, because it disguises the meaning of the equation, and mixes up a factor due to the medium with one derived from an arbitrary choice of units. If μ and K be defined as the ratios, respectively, of the permeability and sp. ind. cap. of the medium to those in air (which was their original meaning), it is obvious that when the medium *is* air each must be unity.

Mr. Carter's position is very strong in that he is able to quote Maxwell on behalf of his choice of definitions, and I doubt not that that great authority was consistent, though, for reasons already given, I dislike the convention he adopts. But later writers are not so scrupulous; they start off with the equation $D = K E/4\pi$ without a hint that they have absorbed $1/v^2$ into the value of K; and if my attack on them has helped any student to see what they really mean, I do not regret having published it.

I have tried to make clear that I appreciate Mr. Carter's contention, and also where and why I disagree with it. I hope he, in turn, will be able to see that I am neither jesting nor out of my depth, but that I have tried to get to the root of the matter. In an article on "dogmatism," it were out of place to rely on authority, however eminent.

W. M. M.

Braking Operations for Tramcars.

In your last week's issue your correspondent, Mr. John I. Hall, contributed his opinion of regenerative control brakes. I have read the leader in your issue of April 19th, and it seems to me that Mr. Hall entirely overlooks the various arguments you have brought forward, and looks at the braking question from a narrowed point of view.

Surely the numerous accidents we have had from time to time provide an object lesson for us, and what is it they all more or less point to? A certain braking equipment has been in regular use for a number of years, and no accident of any moment has occurred, but the time arrives when either the apparatus fails, or the operating of it is not carried out in quite a proper manner.

On some braking equipments, particularly where severe gradients are dealt with, the factor of safety when the brake is working at its normal efficiency is often very small, so that anything contributing to reducing this, creates a risk.

Again, the braking arrangement may fail absolutely, and the only reserve the driver has in most cases is either useless in such an emergency, or so complicated that it requires careful thought and action, which in nine cases out of 10 it does not receive.

Mr. Hall refers to the regenerative brake as being the service and also the emergency one, and considers that by such a combination of braking, all emergencies may be dealt with. There are, to my mind, two ways of looking at emergency braking, and one is the having to control a car in some sudden emergency to prevent collision or accident to the public, and Mr. Hall is quite right in stating that such a brake should require no care or special thought in its operation. There is no doubt that if the service brake can be used for this purpose, the arrangement is a convenient one.

If, however, the only emergency part of the equipment is the ability to apply the service brake in a quick and simple manner, what is the result when such a brake fails? This is the other emergency brake condition, frequently the most

important of the two, which appears to have been overlooked by your correspondent.

While admiring the regenerative brake control, and admitting several of the advantages Mr. Hall refers to, still, I think, he hardly strengthens its case by making extravagant statements with regard to its advantages, and contending that absolute safety can only be secured by such a system.

The accidents that have occurred from time to time with electrically-controlled brakes might, in many cases, equally apply to the regenerative control brake; and although its operation has a certain amount of simplicity about it, no one can fail to admit that, to be worked efficiently, it calls for a certain amount of care and consideration in its use, a requirement inherent with all electrically-controlled brakes.

Security.

With reference to your note on my letter in the current issue of your paper, I am fully aware of the interest in, and the trouble you have taken at different times to investigate, also the favour with which you view, this system of control.

You refer to the great majority of cars at present equipped with series motors, and the tenor of your remarks seems to indicate that a mechanical emergency brake, such as reviewed in your issue of the 12th ult., should be adopted pending the conversion of series motors to the regenerative principle. That may be so, but is there not as much likelihood of the one being generally adopted as the other?

There is *absolutely no likelihood* of a general conversion of series motors to the regenerative system, and I am no advocate of their being so converted. Such a policy would effectually defeat the object in view, and would only bring regenerative control into disfavour on account of the trouble which would ensue. Tramway managers can try the system quite easily—and it is worth the expense—by having the motors of one car converted for demonstration purposes, and by so doing ascertain the advantages, the safety and the economies to be derived on their own particular lines. But to follow a course of general conversion would be unwise and far too expensive for tramway authorities.

Series motors are constructed for series working. They were never intended to work as shunt motors, and cannot be expected to give satisfaction under the increased duty entailed by regenerative control. Anyone expecting good running results might just as well expect a steam boiler of the time of Watt to perform the duty of a modern Lancashire or Babcock boiler. To the credit of tramway managers, they have recognised this, and have refused to go in for the conversion of their motors.

But tramway managers are human beings, and if a suitable and bold policy is put before them they are more likely to be attracted by it than by the alternative.

The only advisable course is to go straight for shunt motors designed for traction work, and the popularity of the system is then assured.

In addition to the safety secured, consideration has to be given to financial results, and, as I pointed out in my paper before the Tramway and Light Railway Association three years ago, the hard and dry facts of the balance-sheet at the end of the year are the only criterion that can be considered.

With converted series motors the probabilities are there would be no economy over present working worth speaking of, but with *suitable shunt traction motors* the results would be worth shouting about. Not only would the results be as anticipated, but the increased efficiency of such motors would add further to the economy in current.

The great advantages of the system have been fully demonstrated, the only factor now remaining to put regenerative control on its feet is the appearance of the shunt motor. The non-appearance of it does not speak much for the enterprise of manufacturers of traction motors and those companies interested commercially in the system, and if it does not come shortly, I fear I shall be obliged to have an interview with some of my friends on this matter, and reap the benefit myself.

Jno. I. Hall.

Kingston-on-Thames, *April 29th*, 1907.

[We said nothing about converting series *motors*; our reference was to the cars—*motors* do not require brakes!—EDS. E.R.]

Fancy Names for Lamps.

If other lamp manufacturers displayed the same spirit as Mr. R. L. Matthews, of the Linolite Co., does in his letter of April 19th, 1907, there would be no cause for complaint. The fact of lamps being in series across high-voltage mains does not prevent each lamp being marked with the current taken, as pointed out by "C. W. G." in his communication on the subject. As the Linolite lamp differs entirely from other forms of incandescent lamps, the special name is quite justified. Manufacturers of the ordinary type of incandescent lamp have no excuse for naming each size of lamp, and omitting to state either the current or the candle-power given by such lamp. By so doing, they are opening the way for dishonest dealing and confusion. I daresay the advent of the metallic filament lamp has had a good deal to do with the present state of things.

W. A. Toppin, A.M.I.E.E.

Greenock, *April 29th*, 1907.

Lynch v. Macartney, McElroy & Co., Ltd.

The attention of my clients, the defendants in this action, has been drawn to the report of this case in your issue of April 26th inst.

I beg to inform you that the case is being taken to the Court of Appeal, and a stay of execution has been granted by Mr. Justice Bigham pending such appeal.

Cecil F. Twist,
Solicitor for the Defendants.

London, W.C., *April 26th*, 1907.

Station Engineers and Contractors.

Although the article by "G. B. B." in the last issue of the ELECTRICAL REVIEW contains a good deal that is true, it is so obviously written from the biased point of view of the contractor that it may not be quite useless to present for general consideration, a portion of the other side of the question.

Articles written by one class of electrical worker abusive of another will do very little to help the industry (on the principle that "a house divided against itself cannot stand"), and it would seem from a careful perusal of his article, that the real grievance which "G. B. B." has, is not that stated in the first paragraph of his letter, that "Electricity, as far as regards lighting, is approaching a standstill" (which is not true), but that he, speaking presumably as a contractor, has been rubbed the wrong way by some station engineer.

Why, does "G. B. B." suppose, have station engineers had to devise "stringent rules" for the guidance of contractors, and in some cases had to institute a wiring department? Simply because in the earlier days of the industry, the then contractor, who was really a gas-fitter with a less smelly name, proved himself so utterly incapable of dealing with the work in an efficient manner, when left to himself, that the industry suffered.

At present the public look askance at electricity (occasionally), and the lay press attribute every possible and impossible fire to electricity because the contractor has in the past acquired such an unenviable reputation for shoddy work.

The cure is not to blackguard the station engineer, but to do such work as will be passed by even the present "unreliable test."

Speaking from the station engineer's point of view, I can say that with the greater number of jobs now being put on the circuits, it is possible to prophesy with remarkable accuracy which of them will pass our "fatuous rules" without trouble, by glancing at the contractor's name.

A man with a reputation for good work has no cause to quarrel with the wiring rules imposed on him by the average supply company, even though they differ widely, with different supply authorities.

Again, I can say that as the result of a steady course of the "frantic and foolish," scissors and paste, and postcard, method of publicity, coupled with systematic canvassing, the situation in the area which is supplied by the authority with which I am connected, is that *we* give the contractor the work, and not *vice versâ*.

It may be meant for humour to deride the special knowledge of the station engineer, but it is very poor humour, as in any case the station engineer knows considerably more about wiring than the contractor possibly can know about station engineering, apart from the fact that there is usually a wiring expert somewhere about a station.

It is a common failing of the unsuccessful to cry down that which they have been unsuccessful in attaining, which *may* account for the cheap sarcasm levelled at the "high altitudes of refinement" on which the station engineer is said to reside.

I have met some 200 of them at different times, and am glad to say for the credit of the profession that they do reside there or thereabouts.

The last paragraph, "What has the contractor done for the station?" is rather delightful when one considers the usual attitude of the said contractor, *especially when there are two supply authorities in one area!*

On the other hand, the reversed question, "What has the station done for the contractor?" can usually be answered by saying, "Taught him his job," especially if he be of the type of man exemplified by "G. G. B.'s" article, who on such slight personal grounds has taken up, or shall we say, gone back to, gas fitting.

The good man who has a reputation to keep up for good work, will not be, and is not, needlessly harassed by the station engineer, but the shoddy jerry men will be harassed until he is worried "off the earth," for which his circuits show such a remarkable predilection.

J. A. K.

Dust and the Electric Light.

I am desirous of knowing the opinion of your numerous readers as to what is the cause of blackened ceilings in the case where flex is run on the same, also the cause of blackened ceiling immediately round ceiling roses.

I certainly think it is an electrical effect, as witness the accumulation of dirt on the glass of a fuse box; half of the glass is quite clean, and the other so dirty you are unable to see the fuses.

A. L. A.

[This is a phenomenon which was much discussed some years ago. The cause is partly electrostatic attraction and partly thermal convection currents; something may be done to remedy the trouble by connecting all switches on the "outer" wire, assuming that a three-wire system is in use with the middle wire earthed. We have not met with the effect mentioned in connection with the glass covers of fuse boards; they are easily kept clean.—EDS. E.R.]

Growth of Battery Plates.

Can any battery expert inform the writer if a Planté positive plate will increase in size with *normal* treatment, and if so, what growth in width may be expected?

The writer has in mind a plate with a solid centre web, with projecting teeth, the plate measuring, say, 13 in. wide when new, and wishes to know what amount of side play to allow between the glass supporting plates.

Anode.

PARLIAMENTARY.

Watford and Edgware Railway.

ON April 23rd a Select Committee of the House of Commons, presided over by Sir Lewis M'Iver, considered this Bill.

Mr. TALBOT, K.C., for the promoters, explained that the Bill related to two railways already sanctioned by Parliament and intended to be physically one line. The sole object of the Bill was contained in Clauses 4 and 5, which extended or revived the power for the compulsory purchase of two properties—one on the northern side, belonging to Mr. R. P. Tebb, and the other on the southern side, the property of the Golders Hill Building Estate, Ltd. The powers for the construction of the line ultimately passed into the hands of the Underground Railways Co., of London. In 1905 the Euston and Hampstead Co.'s powers were about to expire, and there was an extension to 1908, with one exception. In 1906 the Watford company had to take action to extend their powers, and they promoted a Bill, which was sanctioned, and with one exception the powers were extended until 1909. The two exceptions were those which had occasioned the present controversy. The promoters regretted as much as the petitioners that they had been disappointed in regard to their expectations of proceeding with the railway, but the money market had not been favourable to the raising of capital. The petitioners said that the delay was inflicting damage upon them in connection with the development of their building estates, but he could only characterise that as a purely imaginary grievance. The promoters had the substantial approval of most of the landowners, and many had promised substantial financial support. The alternative to the passing of the present Bill was that the powers would cease, and that the money which had been already spent upon the railways would be thrown away, and the intention of Parliament that the lines should be constructed would be defeated.

Evidence on behalf of the Bill was then given.

Mr. HEARNE, a past chairman of the Hendon District Council, said he regarded the making of the railway as of very great importance to Hendon. It would bring them into connection with the Charing Cross, Euston and Hampstead Railway, thus giving them access to the City.

Mr. C. STEEL, chairman of the company, said that the reason the railway had not yet been constructed was because the times had not been propitious for raising the money. He felt convinced that the capital would be forthcoming shortly without any underwriting, and if they obtained their Bill, it was their intention to prosecute the matter forthwith. The capital authorised was £880,000, but he was of opinion that £550,000 would be sufficient to construct and equip the line. The estimated revenue was about £50,000 a year, and taking the capital at £550,000, that would provide a reasonable rate of interest on the investment.

On April 24th, Mr. C. STEEL was recalled, and he handed in a statement showing the financial position of the company, but the contents were not made public. In answer to the CHAIRMAN, he said they intended to ask for powers so as to allow them a 30 per cent. margin on what they required. The ordinary stock that the company wanted to raise was £660,000, and they proposed to raise debenture stock in proportion to the amount of capital they required. The present ordinary shares were £450,000. The Underground Railways Co. was not under any obligation to find the capital, nor was there any agreement to that effect, but they had an arrangement with the tube railways by which their company had a rebate on the traffic carried by the Watford Railway. It was estimated that £5,000 a year would be received from that source. It would take them two or three years to construct the line, and they were paying 2 per cent. interest on the £40,000 they were borrowing for that purpose.

The Committee, after consultation in private, announced that the preamble of the Bill was not proved.

Radio-Telegraphic Convention Committee.

THE Committee resumed on Tuesday, April 23rd, when evidence was given by Sir OLIVER LODGE on behalf of the Lodge-Muirhead Wireless Telegraphy Syndicate. Sir Oliver, in reply to the CHAIRMAN, said he had worked at radio-telegraphy since the seventies, principally on the strength of Clerk Maxwell's theory. It was his ambition to be the first to introduce electric waves in accordance with that theory, and he very nearly succeeded in 1887 and 1888. He was able to detect the waves running along wires, and he published the idea of getting them across space by the discharge of what was virtually a Leyden jar. In the year 1888 Hertz, quite independently, transmitted waves across space, and as a consequence they were very appropriately termed Hertzian waves. He continued to work at the subject, and devised several means of detecting waves. He had used nearly every kind of Hertz oscillator at Liverpool, emitting waves 100 yards long, which caused sparks in the roofs of adjoining buildings and in the water and gas pipes. In 1894, with the assistance of the Branly coherer, the matter became much more definite and easy, and in that year he gave two demonstrations—one at the Royal Institution and the other before the British Association, using Hertz oscillators; the signals were sent from one room to another through walls. It was about this time that Mr. Marconi was struck with the applicability of these signals to practical telegraphy, and in 1896 the whole world became interested in the matter, and it began to assume financial importance. It was in 1897 that he (Witness) obtained his first English patent, which he regarded as the first tuning patent. He then proceeded to patent the fundamental method on which all tuning must be based, and for this purpose he utilised the ideas contained in his sympathetic Leyden jar resonance experiments. The Muirhead Co. had been granted a good many patents since 1897.

Having explained at some length the difference between a tuned and an untuned station, Sir OLIVER gave it as his opinion, from practical experience, that no system yet in vogue had such a perfect tuning as the Lodge-Muirhead. It was possible to make the apparatus insensible to other apparatus tuned differently, even although the other apparatus was wilfully endeavouring to cause obstruction. He could not say how far that applied to other systems. There was not a very great difference between one system and another, except perhaps in the matter of tuning. With proper tuning there need be no undue interference between one station and another, even if they were situated in close proximity to one another, if they were willing and anxious to work harmoniously. If it was deliberately intended to produce disturbance, it would be very difficult to prevent it. His system of tuning was effected by putting in a few pegs or turning a switch, and was the simplest system imaginable. It was perfectly easy to confine the station to

a particular wave length, or they could make the apparatus insensitive, and so receive all and sundry signals. As far as their present experience went, duplex working was not possible with wireless telegraphy, although diplex working was.

Questioned regarding the desirability of intercommunication, Sir Oliver Lodge said that, in his opinion, this should be enforced. It was a matter of such international importance that the claims of rival systems should not be allowed to interfere. He was against a monopoly being granted to any company; and taking into account the work that had been done by different people, he did not think there was any legitimate ground for anybody making such a request. A monopoly would be discouraging to other systems, and would also, in his opinion, be detrimental even to the system which obtained the monopoly. It would be in the best interests of Great Britain that she should join the Convention at the commencement rather than at a later stage.

Answering Sir Edward Sassoon, the Witness said he should have thought that if the business were left to private enterprise there might be confusion; but if it was taken up by a central organisation and arranged there would be less. In his opinion, the Convention would be likely to minimise interference. He had seen the clauses in the Convention, and thought they had been wisely drawn up.

By Mr. Lee: Giving the various systems a chance would be advantageous from a public point of view, as it would lead to the survival of the fittest.

Replying to Mr. Lambert, Sir Oliver said he did not regard the wireless system as one that would supersede cables, for many reasons, but that it would supplement cables, just in the same way as the telephone supplemented the telegraph without superseding it. He believed that the method of effecting communication would be very much improved in the future. Free trade in wireless telegraphy would tend to promote efficiency.

By Mr. Sydney Buxton: As long as the stations worked harmoniously together, interference could be avoided. It would be better to have a large number of small stations with small power, than a few stations with higher power.

Replying to Mr. Gwynne, Sir Oliver said he would never fix stations to one wave length. Each station should have its normal wave length, but it should be able to vary it.

Mr. Henry Muirhead, a member of the Lodge-Muirhead Wireless Telegraphy Syndicate, explained that the syndicate was registered as a limited liability company in June, 1901, for the purpose of defending the interests of Sir Oliver Lodge and his (witness's) brothers. Practically the whole of the shares were held by Sir Oliver Lodge and members of the Muirhead family. They had a wireless telegraph station at Hythe. He hardly liked to call it a commercial station, because they had applied over and over again to the Post Office for permission to communicate with ships, but had only received procrastinating replies. They were disappointed that they were not allowed to use their system for commercial purposes. They quite realised that for defence purposes the Admiralty must rule the roost, but they strongly objected to the Admiralty, in conjunction with the Post Office, having vetoed every system of wireless telegraphy except the Marconi system. In their view, the Admiralty had infringed the 1897 patent of the syndicate. They had asked the Admiralty for permission to institute a friendly action in the Courts to settle the matter, but without effect.

Witness then gave particulars of the foreign stations which his company had established, and said that they had spent many thousands of pounds in adapting their system for the use of the War Office, and that Department had testified that, of all the systems which they had tried, theirs was the best. They claimed that in the Morse tuning patent they possessed the master tuning patent, without which the system was not of much value.

At the resumed sitting on Thursday, April 25th, evidence was given by Mr. Nevil Maskelyne, technical adviser to the Amalgamated Radio-Telegraphic Co., Ltd.

Replying to Sir John Dickson Poynder, the Chairman, Witness said that the company, of which Lord Armstrong was chairman, was registered in September, 1906. It was formed to take over the interests of the De Forest Wireless Telegraph Syndicate, and to amalgamate therewith other interests more recently acquired. The company had a share capital of £500,000, partly subscribed. No public money was invested in the undertaking. All necessary funds had been, and were still being, supplied from private sources as and when required. Considerable sums had been subscribed in that way by British capitalists alone.

What is the commercial and technical standing of the company?—The company has already completed contracts with Government departments in Great Britain, India, Germany and Russia; with the United Shipping Co. for four trans-Atlantic liners; with Messrs. Blumenfeld Bros., and, in addition to these installations, owns five stations in this country and three in Denmark. Among the whole of the foregoing, only two stations—those supplied to the General Post Office for Hunstanton and Skegness—have a range nominally less than 100 miles; 14 of the stations have a range of 200 miles and upwards; eight have a range of 500 miles, and one has a proved range of 800 miles. Continuing, witness said that the company had also in course of negotiation, contracts with the Governments of Great Britain, India, Cape Colony, West Indies, West Africa, Egypt, Norway, Sweden, Austria, Denmark, Italy, Russia, Turkey, China, Manchuria and Borneo, also with various authorities and private firms for stations in Central America, Faroe Islands, Christmas Island, Fiji, Ocean and Pleasant Islands, and in positions not specified. There were also numerous ship installations of various kinds, tenders for which were under consideration. In all, the number of such contracts would amount to between 60 and 70. In many cases, however, the acceptance of those contracts was held in abeyance pending the ratification of the Convention. The technical importance of the company's operations had been officially recognised both at home and abroad. He had been informed that various articles of the Convention were modified, especially in view of the company's most recent improvements in radio-telegraphy. The experts employed by the company were of various nationalities, and included some of the most able and distinguished workers in the field of radio-telegraphy.

What patents have your company actually in force at the present time?—194; of these, 61 are British and Colonial, and 133 are foreign. In addition, there are some 30 patent applications still awaiting acceptance; thus the total number is 224. These include the most recent advancements and most improved methods connected with radio-telegraphy. The following were the names of the various patentees, continued Witness—De Forest, Ducretet, Ehret, Gehring, Maskelyne, Pedersen, Poulsen, Rosenthal, Schiller, Seibt, Sharman and Shoemaker.

Witness then explained the essential points in which the various radio-telegraphic systems mutually differed. The basic Poulsen patents controlling the newer system were owned by his company. Their latest apparatus was capable of working within a comparatively short distance of other installations without suffering disturbance. In fact, when using the continuous wave system in ordinary practice, they were never aware of the existence of waves transmitted by other stations.

Are other stations disturbed by your signals?—No, according to my experience other stations are equally undisturbed by our signals. Therefore his company claimed, and, he thought, reasonably, that they should be allowed to erect and operate continuous wave stations for their own special purposes wherever they might wish to do so. Coming to the Convention, Mr. Maskelyne said that under it they would be entitled to put up stations for their own special purposes. In existing circumstances licences had to be refused them, because such licences would permit them to use the means commonly employed in wireless telegraphy—or, at any rate, there would be nothing to prevent vessels from signalling to them by the ordinary means, and thus interfering with neighbouring stations. The result was that at present they were debarred from obtaining communication in various important localities—notably, on the South Coast of England. They might not erect stations of their own, and the existing stations would not accept messages from vessels using their apparatus. Even the stations controlled by Lloyd's were debarred from communicating with them. They considered that not only a great hardship but also an injustice. Their more perfect system was hampered by restrictions imposed upon them by those who employed an older and extremely primitive system.

Questioned as to whether the restrictions to which he had referred damaged the company at all, Witness said that undoubtedly the present lack of general organisation resulted in the loss of a vast amount of business which otherwise would be done.

You consider it would be beneficial to Great Britain and to the industry if the Convention were ratified?—Undoubtedly, for if the Convention be ratified the detrimental circumstances I have mentioned must automatically cease to exist. Not only would this benefit radio-telegraphic companies in general, but also the particular company which at present refuses to intercommunicate with other systems. The present state of chaos, Witness said, was intolerable and utterly opposed to rational progress, while if the Convention were ratified that chaos would be converted into order. In the second place, the British delegates who attended the Berlin Conference practically dictated the final wording of the Convention. In all matters affecting the interests of this country they carried their point. If he had no other reason for supporting the Convention, those considerations would compel him to do so.

Mr. J. Henniker Heaton, M.P., said that he was convinced that wireless telegraphy would cheapen communication with all parts of our Empire. As to the Convention, he saw no pressing need for it at the present time. The Post Office and the Marconi Co. had not worked harmoniously together, and the Marconi Co. had complained of the bad treatment and injustice done to them by the Post Office.

Pressed by the Postmaster-General to give a specific case of injustice, Mr. Henniker Heaton was unable to do so.

Further replying to the Chairman, the Witness said he thought that the other Powers had everything to gain and nothing to lose by the ratification of the Convention; but, on the other hand, Great Britain certainly would not gain, but would stand to lose. Two or three years ago the Post Office had sent to the Governors of the British Colonies, through the Colonial Office, a letter warning them not to take up the Marconi system, in view of the fact that other systems might come forward later on which might be better. The Marconi Co. had demonstrated the practicability of their system in Australia, and the Commonwealth would, in all probability, have come to an arrangement with them but for the advice of the Colonial Office. He declined to believe that there were any other systems than the Marconi; but pressed to give his reasons for so saying, Mr. Henniker Heaton was only able to say that it was the only system of which he had any knowledge. He had the strongest objection to the compulsory clause in the Convention regarding intercommunication, and thought the Marconi Co. were entitled to refuse to intercommunicate. The Committee then adjourned.

Middlesbrough, Stockton-on-Tees and Thornaby Tramways Bill.—The Lord Chairman of Committees reported last week that all opposition to this Bill has been withdrawn.

Electric Supply Corporation Bill.—In the House of Lords on April 25th the Electric Supply Corporation Bill was read a second time.

London County Council Tramways Bill.

On Thursday, April 25th, Mr. Lambton's Select Committee of the House of Commons commenced the consideration of this Bill. Mr. Erskine Pollock, K.C., and Mr. Lyndon Macassey appeared for the Council, Sir R. Littler, K.C., and Mr. Fitzgerald were for Mr. R. Horner, Mr. Courthorpe Munroe for the Lambeth Borough Council, and Mr. Lloyd, K.C., and Mr. Lankester for the Midland Railway. The Borough Councils of Greenwich, Stepney, Hackney, Islington and Lewisham who opposed, had counsel reserved, as had also the London, Brighton and South Coast Railway Co.

Mr. Pollock said that the Bill proposed to construct certain tramways and to carry out street widenings, but it would be convenient to take the tramways in sections, and he proposed to deal first with No. 3 tramway which was in the Midland and Euston Roads. At present there were in London 127 miles of tramway, of which the L.C.C. owned 118 miles. By 1911 a further 9 miles of tramways would fall in and would be purchased by the Council. The Council were also authorised to construct a further 16 miles of tramway in the county, which had not yet been constructed. Of the 118 miles worked by the Council, 60 had been converted to electrical traction and 58 were worked by horse traction, and of these 58 it was proposed this year to convert 20 miles to electric traction. No. 3 tramway was partly in the Midland Road and partly in the Euston Road, and was in connection with the tramways which came from Hampstead and carried passengers *viâ* St. Pancras Road and Pentonville to the City. As he had said it was desirable to electrify the northern lines, but the existing tramway passed along St. Pancras Road and under an arch of the Midland Railway. To meet the requirements of the Board of Trade with regard to double-decked cars, it would mean lowering the road, where it passed under the arch, by 8 in. When they came to consider this they were confronted with the fact that immediately under the road was the Fleet Ditch and below that was the low-level line of the Midland Railway. Under these circumstances it was too expensive a work to undertake, and therefore they sought to make a deviation along the Midland Road and get over the difficulty. At the present time they carried 10,500,000 passengers per annum along the St. Pancras Road. The only opposition to this line came from the Midland Railway Co.

Mr. Fitzmaurice, chief engineer to the L.C.C., was called, and bore out Counsel's opening statement.

Alderman W. W. Thompson (Chairman of the Highways Committee), gave evidence which supported the statements of Mr. Courtenay.

Mr. A. L. C. Fell (tramway manager) gave various particulars as to the height of the cars, and said that it was necessary to have upon the double-decked cars a trolley base which should be of the height of 9 in.; that was in order that cars might be used for overhead as well as for the conduit system, because in the outlying districts he anticipated that in the future the overhead system would be used, as it was at Highgate Archway. It was possible that there would be a connection with the Middlesex tramways. It was necessary to make the diversion because they could not get the double-decked cars under the arches on any other routes.

Alderman McGregor said that the St. Pancras Council took no objection to the proposal of the Council.

The Committee then heard police evidence as to the state of traffic passing through the streets through which the line would run.

Mr. S. Sellon was called in support of the objection to the Bill.

On Friday, Mr. Guy Granet, manager of the Midland Railway, said his company were opposed to the proposal, as it would make a congestion of traffic in the neighbourhood of the Midland Station, and quoted figures maintaining his contention. He agreed with the report of the Traffic Commission that the road should be widened before a tramway was laid. During the year 9,000,000 persons travelled on the Midland line, and he contended that they were as much entitled to consideration as those travelling by tramway.

Mr. W. Barclay Worthington, chief engineer to the Midland Railway, disagreed with Mr. Fitzmaurice that the surface of St. Pancras Road could not be lowered.

Mr. Moon, K.C., addressed the Committee, and urged that the Council should continue to run their tramways along the St. Pancras Road, and not make a deviation which would cause great inconvenience to those using the railway. He pointed out that the Council could not use the overhead trolley system without the consent of the local authority, and seeing that they had only got that system at Highgate, he thought they were not likely to get it in St. Pancras.

Mr. Pollock pointed out that the Council were debarred by the Board of Trade from fixing the standard for the trolley system on the side of the car. It was not correct to say that the Council had only one section of the overhead system, as they had got that system at Hammersmith and Wormwood Scrubbs, and also lines in consideration at Lambeth and Lewisham.

The Committee rejected the proposal.

Mr. Pollock then opened the second part of the case, dealing with a number of tramways in Lambeth. In conjunction with the trams, certain street widenings had to be made. The lines under consideration came into the possession of the L.C.C. from the London Southern Tramways Co. for a sum of £60,000 fixed by arbitration. They were 5½ miles in length, and it was proposed to work them by electricity, and in certain instances where the line was of single track to widen the road so as to allow of a double track. It was desirable in the interest of the public that something should be done to improve the present system. After lengthy negotiations the Council had decided to make certain street widenings. They had agreed with the Lambeth Council that they (Lambeth) should pay one-third of the cost of street widenings, with a limit of £25,167. The cost of reconstructing the tramways would be £204,100, and the improvements would cost £68,720. All objection to the tramway part of the Bill had been withdrawn. They would endeavour to reconstruct the trams within three years from last October, but he would ask that the Lambeth Borough Council, who had inserted that clause, should assist them to do so.

Mr. Fitzmaurice and Mr. Andrew Young were called, and gave formal evidence in support of the Bill.

The Committee found the preamble of this portion of the Bill proved.

Mr. Pollock then addressed the Committee on Clause 34, which related to the removal of sludge from the conduits. He said that under a former Act the Council were bound to remove the sludge from the sides of the roads within two hours of it being placed there. The County Council under this clause proposed that the local authorities should remove the sludge on payment of a reasonable sum. There were five boroughs out of the 29 boroughs in London through which trams did not run, and there were four Councils—Islington, Lambeth, Lewisham and Stepney—opposing that clause.

Mr. Poyser (Lewisham Borough Council) opposed the measure, and called witnesses in opposition.

On Monday the Town Clerk of Islington raised an objection to Clause 37, and said it would be less costly to appeal to a County Court as a Summary Court of Jurisdiction than to an engineer, in case of any dispute as to what constituted a "reasonable sum." To appeal to an engineer was, in his opinion, a most impracticable way to settle the question. Why should the L.C.C. be treated in a different way to any other local authority as regarded their expenses. A reasonable sum should be paid without going to arbitration. He would suggest that formal notice should be given if the L.C.C. intended the local authority to collect the refuse, as it would necessitate a special service of gangers to clear it away.

Mr. Barber (borough engineer) gave evidence bearing out the town clerk's evidence.

Mr. Erskine Pollock, in reply, maintained that arbitration was the best way to settle any dispute.

The Committee announced that Clause 37 had been altered so as to read that the local authority shall remove all refuse at a reasonable cost, and should there be a dispute it shall be settled by a referee appointed under Sec. 33 of the Tramways Act, 1870.

Sir Ralph Littler then addressed the Committee on behalf of Mr. Robert Horner, and asked that the Council should not be allowed to use the double track in Commercial Street, E., as it would interfere with the interests of the public and be to the prejudice of traders in Spitalfields Market.

Mr. Robt. Horner gave evidence, and said that he was in receipt of all rates and tolls from Spitalfields Market. He had spent something like £80,000 on improving the market, and in 1887 he opposed a proposal to run trams down Commercial Street. He thought that a double service down the street would seriously interfere with the present activity of the market.

Cross-examined by Mr. Pollock, Witness said he objected to the double service down the street, and not to the infringement of the Act authorised in 1901, whereby they had laid the lines nearer to the kerb than they should have done.

Answering the Chairman, Mr. Horner said he believed a double service had been running on Sundays.

Other witnesses were called in opposition to the proposal of the Council.

The Committee decided to allow the service to run.

King's Norton U.D.C. Bill.

This Bill was before Mr. Corrie Grant's Select Committee of the House of Commons last week. Mr. H. Lloyd, K.C., Mr. Hutchinson, and Mr. Casson appeared for the promoters, and amongst the opponents were the Worcestershire County Council (Mr. Ram, K.C., and Mr. S. W. Clark), the City of Birmingham Tramways Co. (Mr. Mr. Moon, K.C.), and the Shropshire, Worcestershire and Staffordshire Electric Power Co. (Mr. Wedderburn, K.C.).

Mr. Lloyd, for the promoters, first dealt with the tramway portion of the Bill, and pointed out that the district had grown enormously of late years. It was adjacent to Birmingham, and amongst other things, the tramways ran continuously from Birmingham into the district. Certain tramway routes were leased to the City of Birmingham Tramway Co. till 1911, and others were worked by the Birmingham Corporation by arrangement with the District Council. In 1901 the Council obtained power to construct certain tramways, and the work was to be completed by 1908, but, owing to the population not having increased quite so rapidly as anticipated, the Council had stayed their hands, and they now asked that the time for the completion of the authorised tramways might be extended for five years. He thought the Tramway Co. were opposing under a misapprehension, for the local authority had no desire to do them any harm, and were quite willing to agree to any clause for their protection.

After evidence had been given by Mr. A. W. Cross, the surveyor to the District Council, it was announced that the Tramways Co. would withdraw their opposition, as a clause had been agreed upon for the company's protection, which provided that nothing should be done which would interfere with the tramways worked by the company, and that omnibuses should not be run along the routes leased to the company, which would in any way enter into competition with the company or prejudice their interests.

The Committee next dealt with certain powers asked for in regard to main roads, &c., and proceeded to the electricity portion

of the Bill, under which the Urban District Council wished for authority to provide their own electricity, and to supply energy outside the district, if they thought it desirable to do so.

Mr. LLOYD, in opening this portion of the Bill, said the local authority had come to the conclusion that the time had arrived when they might safely, and with a good chance of success, begin to carry out their electrical undertaking, and in consequence they were asking for powers in addition to those which they already possessed. The only point on which they were opposed had reference to the clause which sought power to supply outside the district. Their opponents were the Shropshire, Worcestershire and Staffordshire Electric Power Co., who contended that such power as was asked for was against public policy, inasmuch as it would involve expense and loss upon the ratepayers, for the Council could not compete successfully with the company, although the interests of the company might be seriously affected by such competition.

Mr. A. W. CROSS, surveyor, said the District Council obtained an electric lighting order in 1890, but as there had hitherto been no great demand for electricity, nothing had been done. Of late they had received a number of requests for electricity. In cross-examination, witness admitted that the district was originally within the area of the Shropshire Co., and when last year that company came to Parliament for further powers, no suggestion was made that the District Council wished to supply power. The reason that the Council wanted the power was that they might be in a position to supply certain Birmingham tramways if they were asked to do so.

Mr. WEDDERBURN contended that the matter was one of principle. The company had made bargains with the local authorities, and had agreed with King's Norton. The company were intending to put up a power station on the boundary of King's Norton and Birmingham, and now in face of the agreement, the Council wished to supply in the company's area. It seemed somewhat unfair that, having prevented the company from supplying in King's Norton, the local authority should wish to go into the company's area.

After consultation, the CHAIRMAN said the Committee thought that Mr. Wedderburn had made out a case, but they would grant the clause. It was only granted, however, to enable King's Norton to deal with the Birmingham Corporation, and would be limited to that.

In answer to the Committee, Mr. CROSS said that there were suggestions that the tramway from the King's Norton district should be extended to Harborne, and if that were done the Birmingham Corporation would probably not care to carry the supply of electricity all the way to Harborne for those tramways, and King's Norton might be asked to supply the current.

A clause was drafted to carry out the decision of the Committee, and the preamble was declared proved.

West Yorkshire Tramways Bill.—This Bill came before Mr. Emmott's Committee of the House of Commons on Thursday, April 25th, as an unopposed Bill. Mr. Lees (Parliamentary agent) said that power was asked to acquire lands and widen streets to carry out the obligations placed on the promoters by the Parliamentary Committee last session. In accordance with the suggestion of the Board of Trade, Clause 7 of the Bill dealing with the costs of arbitration in certain cases, had been amended, and the Birmingham model clause had been adopted. He was quite willing to take that clause, but asked for verbal alterations. After some discussion, the Committee allowed the alteration asked for in the clause. Replying to questions by the Chairman, Mr. Lees said the power given to the company last year, was to construct a tramway from Halifax to Huddersfield. No capital was yet issued, but he thought the prospects of the company were excellent. The Chairman said they would have a populous district to run through. The Committee passed the preamble, and ordered the Bill to be reported for third reading.

Folkestone, Sandgate and Hythe Tramway Bill.—This Bill came before the Unopposed Bill Committee of the House of Commons on April 25th. The only powers asked for were to widen streets and to run omnibuses. Mr. Lees represented the promoters, and formal evidence having been given by Mr. Jacobs, secretary of the company, the preamble was declared proved.

Telephonic Facilities at Southamption.—In the Parliamentary Papers last week, Colonel Phillips asked the Postmaster-General whether he was aware that the trunk line telephonic facilities at Southampton were in need of improvement, and what steps he proposed to take to place the service on a more efficient footing. Mr. Sydney Buxton, in reply, said that two additional trunk lines between Southampton and London would be brought into use in the next few months. Their completion had been seriously delayed by wayleave difficulties. Additional lines to Portsmouth, Bournemouth, Salisbury, and the Isle of Wight from Southampton, were also being provided for the improvement of the trunk service.

Royal Assent.—The first Commission sat on Monday, when amongst the five Bills which received the Royal Assent was the Portobello and Musselburgh Tramways (Port Seton Deviation) Order Confirmation.

Energy from Blast Furnace Gases.—From *Gas and Oil Power* we learn that the Barrow Hematite Steel Co. have decided to install gas engines driven by blast furnace gas, with a view to obtaining cheap motive power for the steel works. This step was prompted by the increasing cost of ore and coke, which reduced the margin of profit. The plant is to be at work in about fifteen months.

LEGAL QUERY COLUMN.

[Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names may be made. Answers are furnished by a barrister-at-law.]

No. 87.—Electricity Supply—Supply outside Area—Permission.

"C" writes:—"A small electric supply company with which I am connected is supplying, under a provisional order, a small town of about 4,000 inhabitants. A few feet outside the area two private houses are now being erected, and the owners have applied for a supply of electricity.

"The parish in which they are situated is purely an agricultural one, and there is not the slightest possibility of an electricity supply being started therein, and we can take our cable from our boundary direct on to the ground wherein these houses are built, without disturbing the road of the adjoining parish.

"Being a small company, we should appreciate the probable increased revenue we should receive from these two consumers, so might I ask you if, in view of the above circumstances, we can take a service to these two consumers without applying for an extension to our order?

"If an extension is necessary, could we apply for, say, a "concession" to supply these two houses at a small cost, as there is little probability of any more houses being built for some time, and so the cost of an extension to supply the parish would not be worth the outlay."

*** If "C" would comply with the letter of the law, he is clearly not entitled to grant the supply, upon the authority of the Gas Light and Coke Co. *v.* South Metropolitan Gas Co., 62, L. T. 126. But there is a wholesome maxim, *de minimis non curat lex*, which appears to apply to this case; and although it be improper to counsel a breach of the law, the damage which such a breach would occasion to any person or thing is certainly not readily apparent.

No. 88.

"THELMUS" writes:—"A large lighting consumer who has for several years been supplied from the Corporation mains, recently installed a suction gas plant and throw-over switches, using the Corporation supply as a stand-by. This plant is constantly breaking down, and the whole of the load is suddenly thrown over to the Corporation mains at most inconvenient times, and without warning of any sort. Would the Corporation be within its rights in charging the consumer the maximum price permitted by its provisional order; or in compelling him to pay a fixed sum per annum as a minimum stand-by charge? Can the Corporation refuse to give supply, unless this consumer gives reasonable notice when he is about to throw over to their mains?"

*** The grievance complained of is one which has been ventilated in this column before now; there does not, however, appear to be any decided case which throws light upon the subject. We know of cases in which the supply authority have taken the precaution to insert in their provisional order a clause which protects them against consumers who use the supply as a "stand-by"; but that is apparently not the case in the present instance.

As to charging the maximum price, the Corporation cannot, in general, charge one consumer more than another; but, assuming the provisional order is in the usual form, a point arises here which it might be worth our correspondent's while to take into Court. Sec. 19 of the Electric Lighting Act, 1882, provides that "a consumer shall . . . be entitled to a supply on the same terms on which any other company or person in such part of the area is entitled under *similar circumstances* to a corresponding supply." So far as is known, the words in italics have not yet been judicially interpreted; and it is at least arguable that the circumstances of a case like the present are so extraordinary, as to justify a higher charge. Sec. 18 of the same Act, which provides that supply must not be used so as to "improperly interfere with the supply of electricity to any other . . . . person," might also be consulted.

LEGAL.

ELECTRIC LAMPS AND CELLULOID ARTICLES.

CITY FIRE INQUEST.

THE City Coroner, Dr. F. J. Waldo, on Friday, held an inquiry under the City of London Fire Inquests Act, into the cause of an outbreak of fire on the 13th inst. at a shop, 63, St. Paul's Churchyard, occupied by Messrs. Saqui & Lawrence, jewellers. The proceedings occupied nearly four hours, but for the most part they were uninteresting, and hardly any of the witnesses hazarded a guess as to the origin of the fire.

Mr. E. Lunge, barrister, represented Messrs. Saqui & Lawrence.

The CORONER, in opening the inquiry, gave a historical sketch of the powers of Coroners to inquire into the causes of non-fatal as well as fatal fires. The City of London Fire Inquests Act revived, he said, in the City the power which the Coroner lost in 1887 by the passing of the Coroners' Act, and it had worked well as a deterrent against incendiarism. The fire in question broke out at

3.55 p.m. on the 13th inst., and firemen arrived at the spot within four minutes of its discovery. The shop was lighted by means of unprotected flexible electric pendants. This was the third fire on the premises reported to, and visited by, him during the past four years. The first fire occurred in the same shop, and it was reported as being caused by a defective electric circuit, a fuse being blown when being tested by an employé of the City of London Electric Lighting Co. At an inquest on the second fire the jury were unable to ascertain the cause.

Mr. Saqui stated that the two fires mentioned by the Coroner did not originate in the shop, and it was news to him that there had been a fire on his premises. One fire originated in the same building, but his shop was protected by iron sheeting, and was only damaged by heat, smoke and water.

Richard Frederick Mackway, the manager of the shop, stated that he was standing at the counter on the afternoon of April 13th when there was a sudden flash, and the inside of the window case was blown in. He had no idea how the fire occurred. He had noticed no irregularity in the electric lights, none of which had ever gone out suddenly. In 1903 an inspector of the City of London Electric Lighting Co. was testing the meter, and there was an "earth circuit."

Inspector Moody, of the City Police, said some very inflammable material was burning in the bottom of the show-case when he arrived on the scene.

Superintendent Charles Alliston, of the London Salvage Corps, followed the firemen to the shop, which he found well alight. There was a strong smell of camphor, and, apparently, some celluloid was burning in the windows. He instructed one of his men to cut the wires, several of the firemen having had shocks. He had been over the premises since the fire.

The Coroner: Have you formed any opinion as to the origin of the fire?

Superintendent Alliston: I am not an electrician, but it was suggested at the time of the fire that it was an "electric light fire."

Do you mean a fire caused through a defective electric circuit?—Probably that, or a lamp against a celluloid article. I have seen celluloid articles burnt by the heat of an electric lamp. A short-circuit would light a celluloid comb, of course.

There was an explosion, the manager says?—That would probably be an expansion of air in the air-tight window case.

Are these electric light fires on the increase?—Yes, we have had several.

Mr. Lunge: It is not easy to provide against a short circuit?—No.

You have heard of the accidental overcharging of the wires from the central station?—I have heard of it, but I cannot prove it.

Engineer Sibley, of Redcross Street Fire Station, informed the Coroner that he came to the conclusion that the fire was caused by a short-circuit or a fusion of wires.

Mr. Horatio Saqui said in 1903 there was a slight outbreak in his shop caused by a short-circuit. An inspector of the City of London Electric Lighting Co. was inspecting the meter at the time, and the company paid for the damage. There was not a big stock of celluloid at the shop. He had no doubt the fire was caused by a short-circuit.

Thomas Arthur Davis, an electrician in the employ of Duncan, Watson & Co., of Charing Cross Road, stated that he put in the fittings in Messrs. Saqui & Lawrence's shop after a fire had damaged the premises. They were high-voltage fittings. He ran new wires from the distribution boards to the window and put in flexible pendants. If there was a short circuit in the window case, the arc would be so short that there would be no danger of fire unless a celluloid article was in close proximity to it.

Mr. Lunge: The workmanship and the materials were of the best quality? Yes. There was a test by my firm and also by the lighting company.

The Coroner: Do you consider there is any danger of fire from these flexible wires?—No.

Thomas George Watts, inspector of the City of London Electric Lighting Co., could give no opinion as to the cause of the fire. The pressure was 204 volts direct current. He thought the fittings were quite satisfactory, and they were all in good condition when connected. The fuses were in good order and of proper size for the circuits they had to control. On inspection he found that two of the fuses were blown. There was a standard test of the company, and unless work was up to the standard the installation was not passed. The fittings were examined to see if they were suitable for the installation.

The Coroner: Is the flexible pendant suitable?—Yes.

Supposing there was a short-circuit?—It is quite possible that there would be sparks, and anything inflammable might be caught. The thing is protected by the small fuses on the distribution board.

The following verdict was given:—The jury are of opinion that the cause of fire was the close proximity of celluloid goods to the electric lamps or wires in the window.

The Coroner: You do not commit yourself as to short circuit?

The Foreman: We cannot say it was an absolute short circuit.

The Coroner: At any rate it was an electrical fire?

The Foreman: There was nothing else there.

Thermit, Ltd., *v.* Weldite, Ltd.

In the Chancery Division of the High Court on Saturday, Mr. Justice Warrington delivered his reserved judgment in this important test action, by which Thermit, Ltd., claimed to restrain an alleged infringement of certain patents for improved methods in the reduction of metals from their compounds, and also for utilising the heat of the reduction for the purpose of welding other metals. It was alleged that defendants had infringed the patents at their premises, 28, Victoria Street, Westminster, at the depôt of the Manchester Corporation tramways, and the permanent way yards of the Corporation tramways of Leeds, Salford and Glasgow, and at the Camberwell depôt of the London County Council. The defence was a denial of the validity of the patents.

Mr. Astbury, K.C., Mr. Sebastian, and Mr. Colefax appeared for the plaintiffs, and Mr. Bousfield, K.C., and Mr. Walter, K.C., for the defendants.

The case occupied the attention of the Court for a number of days.

Sir James Dewar, Mr. Horatio Ballantyne, F.I.C., Mr. Holt, engineer of the Leeds Corporation, Mr. Holford, tramway manager at Salford, Mr. James Dalrymple, manager of the Glasgow Corporation tramways, Mr. Dugald Clerk, and Mr. Charles Vernon Boys were called on behalf of the plaintiffs, and Mr. James Swinburne, Mr. H. F. K. Picard, of the firm of Messrs. Sulman & Picard, metallurgical chemists, and Mr. Isaac E. Winslow gave evidence in support of the defendants' case.

The facts of the case and the contentions of both sides are fully set forth in his Lordship's judgment, which we give verbatim:—The plaintiffs are the registered owners of three letters patent, all of which are said to have been infringed by the defendants. The first of these three letters patent, No. 16,685 of 1896, is for an improved method of producing metals from their oxides, sulphides and chlorides. The other two are for a method of employing the metal so produced, and the intense heat generated in its production for the joining of separate pieces of metal. The principal practical application of the three inventions is in the joining *in situ* of tramway rails.

The defendants deny infringement, and attack the validity of the patents upon a number of grounds. In the case as finally presented at the Bar, these were reduced, as to the patent of 1896, to the following, namely, want of subject matter, prior user, and lack of utility in reference to certain metallic compounds specified in the defendants' further particulars. As to the patents of 1901 and 1902, the attack on the validity of the patents was not pressed, except that it was contended that unless a particular construction is adopted, which, as the defendants say, would entitle them to succeed on the issue of infringement, the patent of 1901 is lacking in subject matter.

Aluminium has a strong affinity for oxygen, and if mixed in a powdered condition with the oxides of certain metals, and brought to the temperature of fusion, it combines with the oxygen in the compound. The result is a molten mass consisting of (1) alumina slag or oxide of aluminium, and (2) the pure metal. The heat developed in the process of combination is extremely intense. I was told that in the case of iron it is about 3,000° C. Aluminium has a similar affinity for sulphur and chlorine, and acts in a similar manner on the sulphides and chlorides of certain metals.

In the year 1894, Claude Vautin obtained letters patent for "An improved process for the extraction of metals from oxides and sulphides." This was in effect for a practical means of utilising, for the production of metals in a pure state, the affinity I have mentioned and the high temperature developed in the combination of the aluminium with the oxygen or sulphur.

No express directions are given in the specification of 1894 as to the mode in which the temperature necessary to start the reaction is to be obtained, but it is common ground that it was to be by external means. In fact, this invention does not seem to have been put into practice, except by Vautin himself and his assistants. The means employed were, in the case of large crucibles, heating in a coke furnace, and in the case of small ones, heating by means of a blow-pipe flame applied externally and over a considerable area. It was found that in the case of some metals, and notably in that of iron, the reaction when brought about by external heat was of so energetic a character as to partake of the nature of an explosion, and to occasion the loss of a large portion, if not the whole, of the material. In the case of some metals, and particularly chromium, the reaction was quieter. The invention for which the letters patent of 1896 were granted was intended to meet the difficulty I have mentioned. The specification of this patent requires somewhat careful consideration. I need say nothing about the provisional specification; I go at once to the complete. That commences with certain statements of fact, and it is called "An improved method for the production of metals and alloys." The first paragraph is as follows: "If metallic compounds containing oxygen, sulphur, or chlorine, for instance, oxides, sulphides, and chlorides, are heated with aluminium"—I take it that means in connection with aluminium, in contact with aluminium—"the metal of the compound is separated out. When the aluminium is employed in excess, an alloy of aluminium and the metal of the compound is obtained. If different metals are reduced at the same time an alloy of these metals is obtained. This method may also be employed for the production of an alloy of a metal or metals with a metalloid or with metalloids as silicium"—which is the same thing as silicon—"arsen, and so on. The aluminium should be employed in a finely pulverised state if good results are to be obtained, and it is necessary to heat only a little portion of the whole mixture to the temperature of reaction. After having brought this little portion to reaction by the heat of a flame, or of a burning piece of magnesium or by electricity, the adjacent parts of the mixture are ignited successively and automatically by the parts already in reaction; by this method a very soft reaction without explosions is gained." I pause there for one moment. The first of those paragraphs from line 15 to line 21 merely states in general terms the effect of the reaction when certain metallic

compounds are heated with aluminium; and I think that statement is plainly confined to those metallic compounds with which the reaction can take place when they are heated with aluminium. The section of those two paragraphs, beginning at line 22, as will be seen hereafter, is a statement in general terms of the nature of the invention which he is afterwards going to describe. I now come to a paragraph beginning at line 29:—"When the whole mixture of the pulverised aluminium and the compound to be reduced, is heated to the point of fusion by an exterior source of heat, such an energetic reaction takes place that, by its vehemence, a certain quantity of the material is ejected and thrown out of the crucible before the reduction of the compound is fully effected, so that the said quantity of material and the fuel consumed for heating the same are wasted as far as the operation is concerned." In that paragraph he is obviously referring to the process, as he had previously described it in the specification of 1894, and he is pointing out the defect and difficulty to which I have just alluded. Then he comes to a paragraph which begins at line 35:—"Now, it is the object of my invention to remedy this defect or loss, and to this end I cause, as already mentioned, the reaction, instead of taking place simultaneously throughout the whole mass, to take place at one point or place only of the mass; in other words, I initiate the reaction at a certain point or place in the mass, and then cause it to proceed or spread from this portion of the mass to the remaining portion of the same." There he is going back to the second paragraph, and pointing out how that which he has mentioned in that paragraph will meet the difficulty which he has mentioned in the third paragraph. Now he goes on to show how he is going to do it. "To start the reaction I may, for instance, ignite the mixture of pulverised aluminium and of one or the other of the compounds above mentioned in a finely pulverised state"—now the next words, I think, are very important—"(or, more precisely, a small portion of that mixture) by means of a blow-pipe flame directed against it, or by means of a piece of sheet or band magnesium which is inserted into that portion of the mixture, and is then ignited. I prefer, however, to make use of a special igniting mass for starting the reaction, such igniting mass being composed of a similar mixture to that to be treated, but which generates greater heat and gives rise to a more intense reaction on being reduced. The combination or compound forming the mixture must, therefore, be easily reducible, and I may mention as examples of such a mixture, oxide of lead and baric peroxide with aluminium, but other similar oxides and peroxides, may be used, if desired, in combination with aluminium." Now, again, I pause there for one moment. I think it is quite plain that when he speaks of starting the reaction and gives those instances of the means by which it may be done, he is referring entirely and exclusively to the employment of those means for igniting the mixture inside the crucible. With regard to the blow-pipe flame, for example, the blow-pipe flame, he says, has to be directed against it, and the "it" there is the small portion of the mixture. Therefore what he is thinking of is a blow-pipe flame which is to be directed immediately and directly on the mixture to be ignited and not on the outside of the crucible. With regard to the other means—that is to say, the bit of sheet or band magnesium, or the ignition powder, that heating internally is intended there can be no doubt whatever. Now I go on to read the further description on page 3, line 3:—"The igniting mass may either be loosely strewn upon the material or mixture to be treated, and may be ignited by a magnesium band or by a match, or it may be formed into balls or similar bodies by pressure, or by means of a suitable cement, and a magnesium band may then be put into each of the said balls or bodies. The latter are slightly pressed down upon, and into the material or mixture to be treated, and when ignited they start the reaction of the said material or mixture. The reaction may be continued by adding fresh material to that contained in the crucible, and I prefer to press the said fresh material into the shape of cubes, prisms and the like." Again I pause there for one moment. As I understand, the method which is actually in practice adopted by the plaintiffs, and which I saw when the experiments were being conducted before me on March 13th, is that of ignition powder. A little ignition powder is put on the top of the mixture in a crucible and lighted with a match, and in about 30 seconds the whole contents of the crucible are in a molten condition of the intense heat which I have already mentioned. The only point which is mentioned for the first time in this specification in that paragraph, is the continuation of the process by adding fresh material. That seems to me to be a point of considerable importance in this specification, because, at all events, with oxide of iron and those as to which the reaction is violent, it would have been impossible to add the fresh material under the process involving external heating. It could only be done where the reaction, as in this case, is quiet, such as is here described. I go on to read the next two paragraphs. He says: "The aluminium may be replaced by a mixture or an alloy of aluminium and magnesium. By making use of the improved method above described, I am enabled to produce refractory metals, such as chromium, manganese and the like, in large quantities, and on a commercial scale; and I can also produce alloys of refractory metal, as well as of a refractory metal, with aluminium, and also of a refractory metal or metals with an alkali metal or metals, with a metal or metals of the alkaline earths, with the metals of a rare earth or earths, and so on. The metals are gained perfectly free from carbon, silicium" (or silicon) "and other impurities, and that is a great advantage of this method." I am satisfied on the evidence that the statements of fact contained in those two paragraphs are true. I now pass over a part of the specification in which he gives more detailed examples of how he carries it into effect, and so far as the describing part of the specification is concerned, I need only read two lines at the bottom of page 3, because some stress is laid upon them on the part of the defendants. After giving certain examples, he says:—"In the same manner all the metals or their alloys, as already mentioned in the first part of the specification, can be gained." It was suggested by the defendants that those words show that the inventor, M. Vautin, had deliberately informed the world that this process could be carried out in such a manner with all the metals—that all the metals could be gained. In my opinion, to a chemist, as M. Vautin is, and to those to whom this specification was addressed, that would be an absurdity. It was known to chemists, as I shall point out more in detail presently, that there were certain metals with which neither aluminium nor a mixture of aluminium and magnesium would react at all. He then starts to claim his invention in nine separate claims. Nothing turns upon these, and I do not propose to read them, with one exception, namely, Claim 9, because a certain point was made about Claim 9 by the defendants. Claim 9 is as follows: "The described method of producing metals and alloys from metallic compounds containing oxygen, sulphur or chlorine alone, or two of or all; such method consisting in finely pulverising the compound, mixing it with finely pulverised metallic aluminium or aluminium and magnesium, heating a small portion of the mixture to start its reaction and afterwards adding the remaining or main portion, so as to heat it from the heat of reaction of the first portion, whereby the reaction automatically spreads throughout the whole mass, substantially as set forth." That refers to the two or three lines on page 3, lines 9 to 11, about continuing the process. It was said by the defendants that that Claim 9 would cover the heating by external heat of the small portion, and then the adding of the further portion, and that, therefore, it was anticipated by the patent of 1894, or at all events, the claim here made was without sufficient subject matter. In my opinion, that is not the construction of the claim. I think if you read the claim with a view of ascertaining its real meaning, and in reference to the description which has been contained in the previous part of the specification, he is in that claim, as in all others, referring to the internal heating, the heating the small portion of the mixture internally, and then afterwards adding the mixture in the way in which he has described on page 3, as I have mentioned.

To sum up what I have said in reading the specification with reference to the true construction of it; in the first place, bearing in mind, as I have already stated, that it is intended to be read by chemists, I am of opinion that it must be read as referring only to those metallic compounds which are capable of reduction by the action of aluminium; in other words, it is a supplement to the specification of 1894, substituting internal for external heating as the means of producing the temperature of reaction. Secondly, the internal heating is to be of a strictly local character affecting only a small portion of the mixture, leaving the rest cold. Thirdly, Claim 9 is intended to be confined to the internal heating of the small portion, and does not comprehend external heating of such small portion. The defendants contended that the claim ought to be construed in the more comprehensive manner, and so construed is too wide. I think the narrower construction is correct. If the specification is construed as I think it ought to be, then in my opinion, on the evidence there is ample subject matter, and the defence of want of subject matter, therefore, fails.

With regard to prior user, there is no evidence of internal heating having been employed to produce the temperature of reaction, and this defence, therefore, also fails.

There remains the defence founded on the fact that the process will not work with certain metallic compounds. This defence is expressed as follows in paragraph 5 of the Particulars of Objections: "The said alleged invention is claimed generally as operating with all oxides. The alleged invention is wholly useless with many oxides, and the results alleged cannot be obtained." The defendants were required to give further particulars under this head, and those further particulars were as follows: "The following metallic compounds are amongst others useless as alleged in paragraph 5 of the Particulars of Objections: Magnesium oxide, thorium oxide, barium oxide, sodium sulphide, potassium sulphide, magnesium sulphide, sodium chloride, potassium chloride, magnesium chloride." The suggestion of fact contained in paragragph 5 of the original Particulars as limited by the further particulars is true. The invention is useless with the compounds there mentioned, and the results cannot be obtained. But the answer, in my opinion, is that the suggestion in the Particulars as to the scope of the claim is unfounded; it did not extend to all oxides, sulphides or chlorides, but only to those which are capable of being reduced by aluminium under the conditions described in the specification. There are certain compounds in reference to which a chemist could say from thermal data readily accessible whether they would or would not come within the above description. There are others which are on the border line, and it might be necessary as to those to try by experiment, but the experiment would be merely for the purpose of ascertaining whether a particular compound answers a certain description sufficiently indicated in the specification; and the fact that in certain cases an experiment of that kind might be necessary, ought not, in my opinion, to affect the validity of the patent.

Now, with regard to infringement. The defendants have beyond question carried out the reduction of oxide of iron in the manner described in the specification, with one exception, namely, that they have replaced a small portion of the aluminium by silicon, another metal capable of reducing oxide of iron. In my opinion, the true result of the evidence on this point is that this change is a mere colourable variation; that the reduction, notwithstanding the variation, continues to be substantially a reduction by aluminium such as is described. I find this most clearly stated by Mr. Ballantyne in answer to Questions 905, 906 and 907, and this

statement I accept. Viewing the question in this light, I have not, in my opinion, to consider, and do not determine, whether on the evidence a mixture of silicon and aluminium was a known chemical equivalent for aluminium.

The patent of 1901 is described by the patentee as "A new and improved process for welding metals." The defendants' case in reference to this patent is that they have not infringed, because on the evidence it is not proved that the pieces of metal on which they have operated were actually welded together. Further, they say that if the patent covers a mode of joining such as they are proved to have practised, namely, without welding, then the patent is void for lack of subject matter. The material facts are as follows:—In the year 1899 Dr. Goldschmidt, the patentee of 1901, obtained Letters Patent for an improved process for welding metals. The essence of this invention was the employment of the intensely hot fluid resulting from the chemical process described in Vautin's specification of 1896, to bring the two metal surfaces to be joined to such a temperature that under pressure welding could take place. This was effected by pouring the hot liquid into a mould surrounding the joint. The hot liquid in the crucible consists of aluminia slag and pure iron. The iron is the heavier, and in the application of this process it was essential to keep the iron from coming in contact with the pieces to be joined, and accordingly provision was made for ensuring that the aluminia slag should first make a protective covering, the iron being poured into the mould only after this had been done. The function of the iron in this process was only to create or communicate the necessary amount of heat. Another method of joining metals known and practiced before 1901 was Falk's method, which consists simply in casting iron, at the ordinary temperature of molten cast-iron, round the joint. The patentee of that process suggests that this cast-iron will adhere to the two sides of the joint, and will thus hold together. On the evidence before me, I doubt whether it would adhere with sufficient strength to make a firm connection, and Falk met this by providing holes on either side of the joint, into which some of the cast-iron would run, so that the pieces to be joined would be held together by a link of cast-iron.

I now come to the specification of 1901. The patentee describes his invention as follows:—He says, "My invention relates to a new and improved process for welding metals. In the processes known up till now for welding metals with the aid of the heat produced by the chemical reaction between aluminium and oxides of metals or other oxygen-containing metal compounds (especially oxide of iron) the reaction mass is used only as calorifying agent, and the metal produced by the reaction serves only as a heat conductor. Therefore, in these alumino-thermo processes, care was taken that the molten alumina slag at first came in contact with the pieces to be welded, and only after the same had formed a protecting cover or coating around the pieces, the molten metal was cast around the welding pieces. In most cases this succession took place already by the mere casting of the reaction mass out of the crucible or melting pot, as naturally at first the alumina floating above flows out, and afterwards the metal. Hereby it was avoided, that the molten metal could come in direct contact with the metal pieces to be welded and that this metal could join with the metal pieces." So far he is describing the process of 1899. "By my new process it is attained that the molten metal comes directly in contact with the welding pieces, or with part of the same, so that the metal may partly join with the pieces, thereby strengthening the joints, whereupon the whole reaction mass begins its operation as calorifying agent for the welding process. The process shall now be described as, for example, used for joining rails or the like, and with reference to figs. 7, 8 and 9 of the drawings." The process he there describes, which I need not read, is shortly this—that a crucible containing a mixture of ferric oxide and aluminium is placed in a tripod over the faces to be joined. These are surrounded by a mould; the crucible is provided with a tap hole at the bottom. The reaction being effected, the tap hole is opened, and the iron flows out, first surrounding the lower part of the rails to be joined, the aluminium filling up the rest of the mould and covering the upper part of the rails. The patentee then proceeds as follows: "The aluminia flowing out after the iron has a double effect upon the pieces to be joined. Firstly, the heating attained by the same may effect the welding of the joining faces, assuming, of course, that a sufficient pressure is applied to them; secondly, the heating of the upper part of the rails prevents the bending up of the rails near the joining faces which bending up was tried to be done away until now, in similar processes, by holding the joining faces down by means of clamps and the like." He then describes certain modified modes of carrying out his invention in terms which I may pass over. On page 4, at line 38, he sums it up as follows: "It will be seen that the joints produced by this process are produced partly by welding the joining faces together, and partly by surrounding the same with metal. Hereby a great strength and elasticity of extension of the joints is attained, as by the process, not only the thermo-energy of the reaction, but at the same time the physical qualities of the metals are used in that way, that these physical qualities become highly advantageous for the purpose produced by the process, that is to say, for the firm joining of the metal pieces. Contrary to the known process"—he is now referring, I think, to Falk—"consisting in casting metals around the lower part of the rails, I obtain by the new process described above, a better welding or joining of the metal cast around the rail-foot, with this rail-foot by reason of the high superheat of the metal, whereby the joining faces are so joined that one continuous metal piece is formed."

In this case I think I must read the claims. They are as follows: "(1) Process of joining metals by means of the heat arising by the reaction taking place between aluminium and oxygen containing metal compounds, consisting in bringing one part of the metal pieces to be joined together in contact with the highly overheated molten metal arising from the reaction, while the other part of the metal pieces is brought in contact with the molten alumina-slag, substantially as and for the purpose set forth." Then "(2) Process of joining metal pieces consisting in surrounding the ends to be joined with a mould, into which the highly overheated molten metal and molten alumina-slag are cast, in such manner, that the parts to be welded come in contact with the molten alumina, while the other parts come into contact with the molten metal, substantially as and for the purpose set forth." I pause there for one moment. He points out there that if there are parts to be welded the almina-slag comes in contact with those parts, whereas the other parts come in contact with the molten metals. Then "(3) Process of joining metal pieces, consisting in surrounding the ends to be joined with a mould, over which a crucible provided with a tap-hole in the bottom is situated, bringing into the crucible a mixture fit for the alumina-thermo-process, bringing the mixture to reaction and then opening the tap-hole, thus causing the products arising from the reaction to flow round the ends to be joined, substantially as and for the purpose set forth." Then claim 4 I do not think I need read, because this only refers to a particular form of tap-hole, or rather to the mode in which the tap-hole is to be stopped.

Now what is the real meaning of this specification and its claims? In my opinion they mean no more than this: "I show you a means whereby you can effectually join two rail ends or other pieces of metal by means of the alumino-thermal process in such a way that you can, if you are so minded, actually weld the two ends together, or some parts of those two ends, and you will in any case join them effectually by means of the superheated iron, cast round the lower part, which owing to its heat, will become united with the joining pieces." I cannot think that the actual welding of the whole of the joining faces was essential to the patentee's claim. He, no doubt, contemplated a welding, but I think he would be within the patent in carrying out the process as there described, but so arranging the materials that there might be no actual welding, or only a partial welding of the joining faces. I think that is shown quite plainly by Claim 2, and I think it is shown also by the passage on page 3, beginning at line 17 and ending at line 23. Even if the specification is so construed, I find, contrary to the defendant's contention, abundant invention in the application of the superheated iron for strengthening the joints, and, therefore, sufficient subject matter for a patent, even according to this construction of it. In the view I take of the ambit of this invention, there is no question that the defendants have infringed the Letters Patent. They have done the very thing described in the specification, except that an actual welding of the faces was not effected. But I find, further on, the fact that even if actual welding is an essential part of the claims, the defendants threatened and intended to effect this, and that it was by accident rather than by design that, in the cases of which evidence was given, this was not done.

The patent of 1902 is merely for an improved mould for use in the 1901 process. Taken by itself there is really no dispute either as to infringement or validity.

I find as the result of the whole case that the plaintiffs are entitled to an injunction as to all the patents.

British Westinghouse Electric and Manufacturing Co., Ltd., v. Mersey Railway Co.

This case came before the Court of Appeal, consisting of Lords Justices Moulton and Buckley, on Tuesday, on the appeal of the defendants from an order Mr. Justice Sutton, reversing the order of the Master, which directed that further proceedings under the writ should go to arbitration.

Mr. Astbury, K.C., with him Mr. Shaw, in support of the appeal, said that the matter arose in this way: In July, 1901, the defendant company were then working with steam; they agreed to electrify the undertaking, and entered into a contract with the plaintiffs, by which the plaintiffs were to electrify the railway for £600,000 odd. In the contract there were a great many details as to debenture issues, and things of that kind, as to payments. The contract provided that the contractors should execute all the works in accordance with the specification, and to provide all necessary things for equipping and completing the railway, so as to enable the traffic to be worked by electrical power. Another condition of the contract was that the contractors should, if required to do so by the company, provide the company with £240,000 cash, in order to enable it to redeem its debentures, so as to prevent any interference during the construction. Provision was made as to payment, and everything was paid by the defendants except the final payment of £33,600, which was the balance of the contract price. The contract also contained the full arbitration clause. In 1904 the plaintiff company claimed that the works were completed, that the trains were running, and that the power station was in working order, but the defendants had three large engines to make the power, and defendants said that they were too light, and that they were coming to grief. The plaintiffs held that defendants ought to pay the balance of the contract price, but the defendants said that they ought to have the power station put right first. An arbitration took place before two arbitrators and an umpire, who was Lord Dunedin. The arbitrators and Lord Dunedin went and examined the whole system, and in the middle of that arbitration the third engine in the power station came to grief. The plaintiffs said they could not keep it up any longer, and it was arranged

that the parties should meet and try to come to an agreement. In July, 1904, they did come to an agreement, and amongst the terms was one that the £33,600 should be paid by the defendants to the plaintiffs—half after the expiration of three months after the works were fully completed, and the rest nine months after it. The defendants had to issue to the plaintiffs debentures to pay this, and all proceedings in the arbitration were to be stayed, with liberty to apply; 15 other differences and disputes were referred to the same Court. Lord Dunedin believed that as he had taken the matter up, he ought to finish it, and he agreed to finish the arbitration, which was now going on before him on the counterclaim by the defendants. In the state of things on February 8th last, the plaintiffs issued the writ in the present action, when the fresh hearing of the arbitration was then in contemplation. The plaintiffs claimed the money under the agreement before stated, and the declaration that they were entitled to the £33,600. They claimed, further, that the contract work was completed within the meaning of the agreement. Defendants then moved to stay the action, and an order to stay was made by the Master on March 19th, and the learned Judge reversed that order. That was the order appealed from.

Mr. DISTURNAL having supported the order of the learned Judge on behalf of the plaintiffs,

Lord Justice MOULTON, in giving judgment, said the appeal must be allowed. Looking at the writ, he was satisfied and convinced that the disputes in question were disputes which, at the date of the writ, were old standing. In these circumstances, he thought that the action should be stayed, and the matter in dispute go to arbitration. The costs in that Court and in the Court below would be the costs of the defendants, in any event.

Lord Justice BUCKLEY concurred.

AGINCOURT STEAMSHIP CO., LTD., *v.* EASTERN EXTENSION, &C., TELEGRAPH CO., LTD.

THIS case came before the Court of Appeal on Saturday. The appeal was brought from the decision of Mr. Justice Bray on points of law raised prior to the trial of the questions of fact in a claim made by the plaintiffs for damage against defendants.

The MASTER OF THE ROLLS, in giving judgment, said he thought the language of Mr. Justice Bray's declaration was dangerous, but the language of the appellants' notice of appeal was wrong. The actual value of the anchor and chain was not necessarily the full measure of compensation which the company agreed to pay, and in a case like this, where there was no other anchor on board, it seemed to him *primâ facie* that it was not adequate. On the other hand, the language used in this declaration seemed to him to open a field of inquiry which was very wide, and which might result in grievous injustice to the shipowner. He thought the proper order for them to make was to modify the fifth declaration so that it should read, "Further, the liability of the company under the terms of notice is to make compensation for the sacrifice of the anchor and chain sacrificed, but not further to pay damages resulting from such sacrifice."

Lords Justices BUCKLEY and KENNEDY concurred. The former pointed out that the alteration of the declaration would leave open what was the proper amount as representing compensation for the sacrifice of the anchor. A large part of that which was claimed here was far outside anything of that character. They ought not to state what was the proper measure of the compensation, but, as a matter of principle, it was to be compensation for the sacrifice of the anchor.

No costs of the appeal were allowed.

LYNCH *v.* MACARTNEY MCELROY & CO., LTD.

IN regard to this action, which was reported in our last issue, and in which plaintiff was awarded £250 damages on Thursday, April 25th, Mr. Justice BINGHAM announced that he would grant a stay of execution, but he should report to the Court of Appeal, if there was appeal, that in his opinion the verdict was right, but the damages were excessive. The only matter, therefore, open for discussion would be the question of the amount of damages, and he should suggest a reasonable amount.

MARYLEBONE BOROUGH COUNCIL *v.* BENDON.

IN the Marylebone Court, before Judge Selfe, on April 26th, this action came on for trial. It was brought to recover a sum of £61 5s. for supply of electricity to the defendant's premises at Finchley Road, N.W., and this the defendant had paid into court, counter-claiming for breach of contract in changing the system and electric supply from 100 volts to 240 volts, and also for breach of the County Council and Board of Trade regulations in carrying out the same by not making the necessary alterations in the wiring to give sufficient insulation for the increased pressure. It was further alleged that the defendant's house had been rendered unsafe and dangerous to life by risk of fire and leakage, and that, in order to remedy these defects and render the installation safe, a complete alteration of the wiring of the premises was necessary.

Mr. ELLIS GRIFFITH, for the defendant, stated that the action, which was a very important one to consumers of electricity in the district, had been settled by the Borough Council taking the money out of Court and undertaking to re-wire the defendant's premises and carry out such alterations as were necessitated by the change of system, and also to properly reinstate all decorations. He asked that judgment be entered accordingly. He submitted that in view of the importance of the case costs should be given on the higher scale.

According to the *Standard*, his HONOUR said it was scandalous that an action of such importance should be remitted from the High Court to the County Court. In addition to the Borough Council paying an enormous sum for the installation, it meant they would have to re-wire the whole of the district. The Judge added that he had no power to grant costs other than on scale C, but having regard to the fact that it was a case of such importance, he directed that they be taxed on scale C, with all special allowances and costs under extended jurisdiction of the 1903 Act.

NORWICH CORPORATION *v.* NORWICH ELECTRIC TRAMWAYS CO., LTD.

THIS arbitration case was opened in Queen's Bench Court 2 on April 18th, and occupied a number of days. Mr. Alfred Lyttelton, M.P., sat as arbitrator. According to a Norwich paper, the issue was the old dispute as to the upkeep of the roads in those thoroughfares through which the tramways are laid.

TRAMWAY CLAIM.

BEFORE Mr. Justice Bray and a common jury last week, Mrs. A. H. Foster was awarded £100 damages against the South Metropolitan Electric Tramways and Lighting Co., Ltd., and Messrs. T. Tilling, Ltd., jointly, for injuries sustained by her in a collision between a tramcar and a horse omnibus on July 21st, 1906.

BOURNEMOUTH CORPORATION *v.* POOLE AND DISTRICT ELECTRIC TRACTION CO., LTD.

THIS case came on for further consideration in the Chancery Division of the High Courts of Justice before Mr. Justice Joyce last Friday. With regard to three items in the dispute—Parliamentary deposit, £1,875; sundry debtors, £544; and cash in hand, £1,410, Mr. Justice Joyce had decided that all these three items did belong to the Poole Traction Co. in connection with the railways and works or management thereof, and therefore passed to the Bournemouth Corporation. The question for further consideration concerned a sum of £7,000, a bank loan; and the points as to whether it was incurred in the ordinary course of business and was outstanding at the appointed day, December 31st, 1903. It had been referred to the Official Referee to ascertain the facts and to go into the accounts. That report was now referred, and after arguments by counsel, Mr. Justice Joyce said it was not clear that the report came to any definite conclusion. The matter must be referred back to him in writing from the Official Referee, and a clear indication as to what the report decided.

LONDON POWER PROBLEM.

THE PROBABLE SOLUTION.

THE power users of London are awaiting with considerable interest the effect of the recent County Council Elections upon the electrical situation. There appears to be little doubt that the Bill which was promoted by the last Council, particulars of which appeared in the ELECTRICAL REVIEW of November 2nd and 9th, 1906, will be very much modified.

Parliament has indicated, through the mouth of three of its Committees in succession, that it is satisfied that a comprehensive scheme of power supply is necessary, and has recommended that the County Council should be the controlling authority. But Parliament has never yet recommended that the County Council should itself be the trading body for supplying electric power, and it would now appear as though this were unlikely to come about. But although that section of the present Bill which deals with the purchase by the Council of the existing undertakings and the establishment at the Council's expense of a vast scheme of power supply is likely to be dropped, it by no means follows that it is desirable to drop the Council's Bill entirely, as is being suggested in some quarters; for the Bill of the L.C.C. contains a number of important provisions for the protection of the consumer, without which it would be much more difficult for the Council to safeguard his interests and those of the ratepayer when preparing to make an arrangement with private enterprise for carrying out the work, which appears to be the policy likely to commend itself to those in power at Spring Gardens. To ensure this, and to enable the Council to negotiate to the best advantage with

private enterprise, it would appear to require a Bill of its own. In fact, it is difficult to see how else the Council's control is to be secured.

To obtain a Bill which, when handed over to private enterprise, can be worked at a profit, it will be necessary for the Council to bear in mind the unfortunate experience of those power companies which, in order to diminish opposition, whittled away their Bills until nothing was left worth having. It is often asked why some of the power companies in this country have been so successful, while others, apparently working in equally rich districts, have resulted in hopeless failures. An examination of the powers granted to these various authorities shows that the principal reason has been the weakness of the Bills obtained. In some cases the municipalities have succeeded in getting the "fat" areas entirely excluded; in others they have compelled the companies to enter into agreements to supply at unremunerative prices. If the County Council makes a similar mistake it may, perhaps, somewhat facilitate the passage of its Bill, but when it obtains the powers they will be found to be of no value to any responsible private company.

To give an example, the L.C.C. Bill at present contains the well-known "Kitson" Clause, under which a supply for power purposes may be given in districts where lighting (and to a certain extent power also) is already being supplied by municipal and private lighting authorities, in cases where the Board of Trade is satisfied that the consumer cannot obtain a supply equally well and equally cheaply from these lighting authorities. This will involve, of course, a certain amount of competition. It is true that competition will be limited to a comparatively small proportion of the total revenue which the lighting authorities in London are at present obtaining; the power user at present provides probably less than one-tenth of the total revenue, although a somewhat larger proportion of the total output. But still for this there will be competition.

The thing to be remembered, however, is that the proportion of *profit* derived from the power supply is very much smaller than the proportion of *revenue*. This is clearly shown upon examination of the figures.

It may be said that this load enables the working cost to be reduced, and to some small extent this is probably true. But when it is also argued that the power user should bear no share of the capital charges, it is obvious that this involves supplying him at the expense of the lighting consumer, even if the addition of the power load involved no additional capital expenditure. As a matter of fact, in the winter the power load adds very considerably to the peak, and, consequently, to the capital outlay required on generating machinery and mains, while a proportion of the latter—that used for house services—is exclusively required and used for power purposes in many cases.

Thus, the profit from power business at the low prices prevailing in London to-day cannot be very large, and must still further decrease if the tariff now proposed in the Bill of the existing lighting companies, which is the same as that formerly proposed in the Administrative Company's Bill, should come into force, for it will be remembered that the average price under this tariff was shown to be only about ¾d. per unit. Hence, although the power consumer brings *load* to the companies, he does not bring much *profit* in any case, and in many cases it would seem that he is being supplied at a loss.

The alternative policy before the County Council would be, instead of pushing forward with its present Bill, after deleting the expenditure clauses, to make arrangements with the promoters of some of the other private Bills at present before Parliament. This alternative at first found favour at Spring Gardens, but upon examination it has been seen that this involves several difficulties, and would probably result in the Council's not obtaining such good terms for the London ratepayer and consumer as it could secure with a Bill of its own. The first of these alternative measures—that of the Administrative Co.—is a permissive Bill only, merely enabling the company by agreement with the Council to exercise all or any of the powers which Parliament may confer upon the Council. It is obvious that this Bill itself guarantees no supply of power to the consumer.

The second Bill is that promoted by the existing companies, of which particulars have already appeared in the ELECTRICAL REVIEW. Briefly speaking, its principal features are :—

(*a*) A reduction in the price of power in the companies' existing areas.

(*b*) A provision for bulk supply over a large additional area.

(*c*) Permission to link up existing stations;

(*d*) Permission to amalgamate their undertakings, and put a stop to competition.

(*e*) Permission to extend the date of purchase from 1931 to 1949.

So far as the areas of the existing companies go, this Bill would undoubtedly provide a supply of cheap power to a number of users, although it gives no new benefits to consumers under 5 KW. or to short-hour users. Moreover, as the areas covered by the existing companies embrace only some 16 per cent. of the total area included in the L.C.C. Bill, it does not offer that "comprehensive" solution which Parliament has recommended. In these outer areas it is proposed to sell in bulk to the existing authorities, who, it is anticipated, will thus be enabled to reduce the price of power to their consumers. There is, however, no guarantee that the consumers in the districts outside the companies' areas, which happen to be the districts where power users most abound, will obtain any reduction in the price of power, and there is no obligation upon anybody to give the consumers in these districts power at low prices, although Parliament has indicated that such an obligation is essential. But the linking-up of the existing stations will undoubtedly enable economies to be effected in the cost of production, though whether these would be sufficient to enable power to be profitably sold at ¾d. per unit, is a point that has to be proved.

The section of the Bill, however, which is likely to meet with the greatest opposition in Parliament is not the proposal to link-up, which it is generally realised is reasonable enough, but the proposal to amalgamate, and thus to abolish that competition in the lighting business which the Board of Trade instituted in 1889 for the protection of the consumer. Whether competition among electric lighting companies is the best way of safeguarding the consumer is open to doubt. The sliding scale of price and dividend, the auction clauses, and the other safeguards which Parliament has arranged in gas, water and power undertakings are probably quite as efficient. But competition is the safeguard which Parliament has provided in London, and the present House of Commons is hardly likely to abolish it.

In conclusion, therefore, it hardly appears that either of the alternative private measures before Parliament offers the same advantages to the public and the consumer, as would be offered by a first-class power scheme controlled by the County Council, but owned and worked by one of the existing or new companies or a combination, and it seems not improbable that this will be the ultimate solution of the difficulty.

BUSINESS NOTES.

Germany.—A company has just been formed at Witten, with a capital of £50,000, to be known as the "Accumulator Gesellschaft in Witten."

Belgium.—The Bell Telephone Manufacturing Co., of Antwerp, reports a profit of £19,810 for the last financial year.

Recent Bennis Stoker Contracts.—Among the contracts obtained between February 1st and April 18th by MESSRS. ED. BENNIS & CO., LTD., is one for eight chain-grate stokers for Melbourne; one from Amsterdam for 16 stokers and self-cleaning compressed-air furnaces with one conveyor; for the Llandudno Corporation the firm are to supply two stokers and compressed-air furnaces to the electricity works, this being a repeat order. We have before us a very lengthy list of the contracts recently booked, considerably over one-third of which are repeat orders. Those of electrical interest are as below:—

For the Electric Supply of Victoria, Melbourne (per British Insulated and Helsby Cables, Ltd.—Eight chain-grate stokers.

For the Spennymoor Electric Station, Spennymoor (per Richardsons, Westgarth & Co., Ltd., Middlesbrough).—Four chain-grate stokers.

For the Central Electric Supply Co., London (per Babcock & Wilcox).—Six chain-grate stokers.

For the Llandudno Corporation Electricity Works.—Two stokers and compressed-air furnace (repeat).

For the Gemeente Electriciteitswerken, Amsterdam.—16 stokers and compressed-air furnace, one conveyor

Trade Announcements.—Messrs. W. E. Burnand and Co. have removed to their new works, Chippinghouse Works, Lowfields, Sheffield, which are equipped with modern plant and are capable of dealing with treble the output possible in their former premises.

Messrs. James Dowie & Co. have this week removed to 15, Water Street, Liverpool.

Messrs. R. J. Nicholson & Co., of Manchester, announce that the growth of their business has necessitated direct representation in London, and they have therefore arranged for offices at 46, King William Street, E.C., where inquiries will receive attention from Messrs. Umney & Becket, who have charge of this end of the business, and who will cover not only the London district proper, but also the counties of Essex, Hertfordshire, Middlesex, Kent, Surrey, Berkshire, and Hampshire. Messrs. Nicholson make a speciality of direct-coupled petrol engines and dynamos for electric lighting and other purposes. An illustrated catalogue "Light in the country" is available on application, and one of the sets can be seen running at the showrooms at Macdonald's Lane, Corporation Street, Manchester. The head office telephone No. is 5,432 Central, and that of the London office is 9,876 Central.

The firm of Henrich Remy, crucible steel maker, of Hagen, Westphalia, has been converted into a limited liability company under the same name.

In order to meet the business demands of Edinburgh and district, Messrs. Anderson & Munro are increasing and re-arranging their office staff there (63, Queen Street). Mr. Donald Smeaton Munro, A.M.I.E.E., is going from the head office of the firm in Glasgow, to take full resident charge of the firm's electrical business in the East.

Mr. J. S. Schlegel has acquired the business of the Sheet Zinc Plating Co., Milford Works, Battersea, S.W., which he will continue under the style of the Sheet Metal Plating Co. at the same address, making a speciality of nickelled, brassed and coppered tinplates.

The Union Electric Co., Ltd., state that, owing to the increase of their business in the northern districts, their Newcastle office will be moved, as from May 6th, to 50, Grainger Street, Newcastle-on-Tyne.

The Armorduct Manufacturing Co., Ltd., want our readers to take note that, owing to many complaints received from customers regarding delays in obtaining telephonic communication with them, they have added a second line. Their numbers are as follows: 1,394 Holborn, 5,739 Holborn.

Messrs. Newtons, Ltd., of Taunton, have appointed Messrs. Berry, Skinner & Co., of 16, Oozells Street, Birmingham, sole agents in the Midland Counties for the sale of their continuous current dynamos and motors. Messrs. Berry, Skinner & Co. have a large number of Newton motors in stock at their Birmingham address, wound for various standard voltages, and can give all information respecting Messrs. Newtons' manufactures.

Dissolutions and Liquidations. — Headley, Ltd., Truro.—The receiver and liquidator (Mr. W. Rowe) has issued an abstract of his accounts, showing a balance of £14 odd in hand, which will be absorbed by his expenses. He regrets, therefore, not being in a position to declare a dividend to the creditors. The total receipts were £1,594, including £1,500 received from sale of stock, &c. Of this, £1,500 was paid into Court to meet debenture-holder's claim, rent, rates, receiver's remuneration, legal and other charges, &c.

Deep Leads Electric Transmission Co., Ltd.—This company is winding up voluntarily, with Mr. E. S. Rawson, 20, Copthall Avenue, E.C., as liquidator.

Victor Arc Lamp Co.—This company is winding up voluntarily, with Mr. W. C. Penny, 8, Arthur Street West, E.C., as liquidator, and a committee of inspection to assist.

British Electrical Tool Co., Ltd.—A meeting to hear an account of the winding up from the liquidator (Mr. C. S. Holliday) is to be held on May 29th, at 4, Greek Street, Leeds.

Calais Tramways Co., Ltd.—A meeting is to be held on May 31st at 57, Moorgate Street, E.C., to hear an account of the winding up from the liquidator.

Rand Central Electric Works, Ltd.—Creditors must send particulars of debts, &c., to the liquidator, Mr. Henry Rogers, 120, Bishopsgate Street Within, E.C., by June 12th.

Bankruptcy Proceedings.—Ernest C. Holt, electrical engineer (Holt & Co., Queen's Arcade, Rhyl).—May 16th is the last day for receiving proofs for intended dividend. Mr. L. Hugh-Jones, official receiver, Crypt Chambers, Eastgate Row, Chester.

K. C. Moran.—A petition was filed in the Walsall County Court on Saturday by K. C. Moran (K. C. Moran & Co., of 80A, Teddesley Street, Walsall, electrical engineers and contractor), and the usual receiving order appointing the Official Receiver (Mr. S. Wells Page) receiver of the estate, was made.

Samuel Hargreaves, electrical engineer, Buxton.—A first and final dividend is now payable. Official Receiver's offices, 23, King Edward Street, Macclesfield.

Prices Advance.—Messrs. Baxendale & Co., of Manchester, announce that, on account of the present high prices of raw materials, they are compelled to advance all the prices contained in their electric bell list (December, 1906) by 5 per cent.

Special Chains.—The Chain-Belt Engineering Co., Derby, are making the special water-chute chains for the Dublin International Exhibition, and the White City, Manchester. They have also just completed a new chute chain for Earl's Court Exhibition, London.

Catalogues and Lists.—British Thomson-Houston Co., Ltd., Rugby.—Two new pamphlets in the company's standard form and style for filing. No. 201 describes their single-phase motors, and No. 202 details their rheostatic controllers and resistances. They are to take the place of lists issued in July, 1905, and May, 1906, respectively.

The General Electric Co., Ltd., Queen Victoria Street, E.C.—Two new leaflets. One describes very briefly the process, also the appearance and advantages, of their Sherardised Geekoduct, which is claimed to be weatherproof and non-rusting. The other circular shows a wind-direction indicator, which is recommended as an attractive and unique electrical advertising device for shop windows, and for use in hotels, club-rooms, &c.

C. W. Hunt & Co., New York.—Engineers' edition (fully illustrated) of their catalogue of the "Hunt" coal-handling machinery.

Messrs. Griffiths Bros. & Co., Bermondsey, S.E.—Leaflet relating to their "Ohmaline" insulating varnish.

National Telephone Co., Ltd., Telephone House, Victoria Embankment, E.C.—Three further sections of the company's new sale catalogue have just come to hand. They are: Section 3, relating to telephone switchboards of several patterns; Section 4, showing, and stating prices of, a large variety of electric bells, pushes, indicator boards, &c.; Section 9, dealing with tools, steel conduits and sundries for telephone and telegraph work.

Messrs. Marples, Leach & Co., 6, Victoria Avenue, London, E.C.—Monthly stock list of direct and alternating-current motors in stock in London and at the works.

The Westminster Electrical Testing Laboratory, York Road, Westminster.—Circular relating to incandescent lamps—why, how, and by whom they should be tested.

Messrs. Newtons, Ltd., Taunton.—New catalogue giving half-tone views, dimensional line drawings, and brief descriptions of their Zone dynamos and motors. In the various sheets, which, caught in the usual binder, comprise this catalogue, there are lists of dynamos and motors of all standard outputs, and in 18 sizes for continuous current. The makers claim that these machines, owing to the special patented field winding, will run with fixed brushes from no load to 50 per cent. overload, and they also claim to obtain the same results as regards sparkless commutation and speed variation by shunt regulation as are only obtained by other makers by the use of commutating poles.

Messrs. John Ruscoe & Co., Ltd., Albion Works, Hyde, Manchester.—Twelve-page illustrated list describing Turner's patent "Triumph" cable-drum carriage—a one man one horse affair—which enables the expeditious and economical distribution of large and heavy cables.

Falk, Stadelmann & Co.'s. New Premises at Glasgow.—The new premises of the above firm were officially opened in Glasgow last week. It may be of interest to refer briefly to the history of the firm. It was formed in London 25 years ago by Mr. S. Falk, who is now the chairman and managing director of the private limited company. The premises of the firm in London, and their large extension in recent years, are already familiar to electrical men. The company's relations with Scotland extend back over many years, and until August, 1905, the Scotch business was dealt with direct from London and by representatives who were directly attached to the London House, but 21 months ago premises were leased at 76, Great Clyde Street, and the whole of the Scotch trade was transferred there. At that time the premises consisted of a one storey building, facing Great Clyde Street, connected with a warehouses of six storeys behind, with entrance to Fox Street, the total floor area, at that time, being 19,000 sq. ft. Within a few months after the premises were opened, it was found that, to do justice to the business in Scotland, more accommodation was necessary, accordingly the ground and premises were purchased, and temporary quarters having been found in Howard Street, the showrooms and offices—which occupied the whole of the one-storey building in Great Clyde Street—were, on June 7th, 1906, removed to their temporary premises, the one-storey building was taken down, a basement 10ft. deep was excavated, and a building of eight storeys (including the basement) was erected on the site. On December 15th, 1906, seven months afterwards, the new building was finished and the temporary premises vacated. The new premises include some fine showrooms for the display of their electrical, oil and gas lighting fittings and apparatus. The resident manager in Glasgow is Mr. A. C. Taylor, who has been attached to the company in London for some years, and who, prior to this, was engaged in a similar capacity in Scotland, and is thus fully aware of the requirements of the Scotch trade. Mr. Taylor's immediate staff were associated with him in London, and have been trained in the service of the company.

Paterson Purifiers.—Amongst the orders lately completed by the Paterson Engineering Co., Ltd., are the following:—

City and South London Railway Co.—Water softener, with quartz sand filter of 6,000 gallons hourly capacity.

Sydney Electricity Works, Australia.—Grease eliminator of 6,000 gallons hourly capacity.

War Office, for Royal Arsenal, Woolwich.—Two water softeners, with quartz sand filters each of 2,000 gallons hourly capacity.

London and North-Western Railway Co.—Repeat order for a grease eliminator and make-up softener of 2,500 gallons hourly capacity.

Lowestoft Electricity Works.—Grease eliminator of 3,000 gallons hourly capacity.

The "Organiser" Exhibition.—Messrs. C. Larkins and Co., of Bush Lane House, E.C., have just received the appointment of official contractors to the "Organiser" Exhibition of Office Appliances and Business Systems, which is to be held at Olympia from July 4th to 13th.

"Premier" Petrol-Electric Set.—We recently had an opportunity of inspecting one of these sets designed for charging ignition cells, of which a description was given in our issue of April 19th. The dynamo had an output of 25 amperes at 10 volts, so that it was capable of charging thirty-two 4-volt batteries of the 25-A H. ignition size, arranged two in series and sixteen in parallel, or other sizes in proportion. The set was partially loaded, and was running at 1,200 R.P.M. Although the engine was the first of its kind constructed, and therefore lacked the refinements of design which, as the result of the experience gained, are being embodied in the standard engines now under construction, it was running very well, and the voltage was maintained at a value which varied but little from the normal. The whole of the apparatus, including the circulating water tank and paraffin tank, was very simple and compact. The engine is driven by ordinary paraffin oil, a feature which conduces greatly to the safety of running and to the ease of obtaining supplies of fuel. It can, of course, equally well be applied to the driving of small machines, tools, &c., and although it is made at present only in the ½-H.P. size, there will be no difficulty in making larger sizes. A large number of the ½-H.P. sets are already on order. Full particulars can be obtained from the PREMIER ACCUMULATOR CO., LTD., Caxton House, S.W., and the set above referred to may be seen working.

LIGHTING and POWER NOTES.

Barnstaple.—The T.C. has decided to supply electricity to the Derby Lace Factory at 2¾d. per unit.

Blackpool.—The electricity undertaking has so rapidly improved its position, that from a loss of £205 in 1901, and a profit of £59 in 1902, its estimates this year provide for a surplus of £8,000. The tramway surplus amounts to £10,042.

Colne.—The T.C. has decided to increase the plant at the electricity works by the installation of an engine, boiler and dynamo, at a cost of £4,000.

Continental Notes.—ITALY.—A central electricity station, with the motive power supplied by gas engines using producer gas, is about to be established for the electric lighting of the towns of Chiusi and Sarteano.

Coventry.—At a ratepayers' meeting on Saturday, sanction was given to the Bill promoted by the T.C. for powers to supply electricity to the parishes of St. Michael Without, Holy Trinity Without, Stivichall, Allesley, Coundon, Stoke, Foleshill, and Exhall.

Dublin.—Messrs. Dick, Kerr & Co. and Messrs. Willans and Robinson have written complaining of the misstatement regarding their plant, made at the last T.C. meeting, and a firm of solicitors, acting for the last-named firm, have written asking that their clients may state their case before any contract is sealed. Mr. Mark Ruddle, the city electrical engineer, has also declined to accept any responsibility in connection with the tender selected by the Council against his recommendation.

Edinburgh.—Provisional estimates for the ensuing year were submitted last week to the T.C. The total estimated expenditure for the year from May, 1907, to May, 1908, is £65,840, as against the estimate of £60,075 for the current year, and an actual expenditure of £53,127 in 1905-6. The estimated revenue for 1907-8 is £130,305, as against an estimated revenue in the current year of £124,900, and an actual revenue in 1905-6 of £121,362. The estimated capital expenditure for the year is £42,545. The number of lamps for which application had been made for the year was 71,680. The secretary of the Scottish National Exhibition, 1908, has written, estimating the exhibition lighting at 100 arc lamps and from 20,000 to 30,000 incandescent lamps will be required for the Exhibition.

Erith.—A L.G.B. inquiry was held on Friday into the application of the T.C. for a loan of £3,000 for electricity purposes. There was no opposition.

Farsley.—The U.D.C. recently obtained powers to supply electricity in the district, and a bulk purchase scheme was adopted, the necessary mains being laid. In spite, however, of an energetic canvass, not a single consumer has been so far obtained.

Heswall (Cheshire).—The project of supplying Heswall with the electric light is again occupying the attention of the local Council. The cost of a scheme for carrying out the work has been estimated at £11,000. This scheme, prepared by a Liverpool firm of electricians, provides for a supply of electricity to dwelling houses at an average rate of 5d. per unit for 18 hours' use, but with a reduced sliding scale for large consumers, and still lower terms for those who may contract for a two years' use of the light. As bearing on this proposed scheme, it is being pointed out that the neighbouring township of Prenton is supplied with electricity for lighting by the Corporation of Birkenhead at 7d. per unit where contracts have not been made, and at 4d. a unit to contractors for the first 500 units per quarter, 3d. per unit for each additional unit consumed beyond the first 500, up to 1,500 units per quarter; and at 2½d. for all units consumed beyond 1,500. The scheme for supplying Heswall with the light, which is now before the Council, compares favourably, it is contended, with the plan now working at Prenton.

Lancaster.—It is proposed to illuminate the Ashton Memorial (now in course of erection in Williamson Park through the generosity of Lord Ashton) by electricity, and the estimates of the cost of extending the main to the Park from Derwent Road amount to about £300.

Liverpool.—A new building in Hatton Garden will shortly be opened as the headquarters of the managerial and clerical staffs of the Liverpool Corporation tramways and electricity undertakings. At present the staff of the tramways is divided between the head office in Sir Thomas Street and an office in Hatton Gardens; whilst the electric supply staff are housed in the building in Highfield Street. Exclusive of the cost of the land, and the furnishing and fittings, the new offices represent an outlay of £48,650.

London.—MARYLEBONE.—At the meeting of the B.C. on April 25th, the E.L. Committee reported that the contract with Messrs. Parsons for the electrical generating plant at the station provides for a bonus being given to the contractors in the event of the turbines coming up to a certain standard of steam efficiency. The official steam consumption tests on the turbo-generators have been carried out, the results being as follows:—Nos. 1 and 2 machines produced a net KW.-hour for 21·99 lb. of steam, bonus ——; Nos. 3 and 4, 22·08 lb., bonus ——; No. 5, 17·17 lb., bonus £2,097; No. 6, 17·88 lb., bonus £1,458; No. 7, 17·2 lb., bonus £2,070; No. 8, 17·1 lb., bonus £2,160. Clause 14 of the specification enables the Council to reject the smaller turbines should the consumption exceed 220·51 lb., and entitled the manufacturers to a bonus of £900 for every lb. of steam under 19½ lb. on each of the large sets. From the above figures it appears that Nos. 3 and 4 are about ½ per cent. higher than the rejection figure, but as this is within the limits of the observation error, the B.C. decided on a deduction being made at the bonus rate on account of this slight excess. The B.C. further approved a certificate in favour of Messrs. Parsons, showing an amount of £7,770 due to them as bonus in accordance with the foregoing report. The Comptroller of the L.C.C., replying to an inquiry, wrote holding out no hope of any reduction in the rate of interest for the electricity loan of £1,400,000 at 4 per cent. Owing to this the estimates of income and expenditure for the year to end March 31st, 1908, have been amended, and the estimated balance applicable to depreciation &c., has now been put down at £11,218.

L.C.C. LOANS TO LOCAL AUTHORITIES.—A long discussion took place at the Council meeting on Tuesday on the subject of loans to local authorities during the year 1907-8. The Finance Committee, in the course of a report, stated that at a time when the necessity for limiting the Council's own expenditure was engaging attention, steps should also be taken to reduce the amount to be lent to other authorities, and as a step in this direction it was proposed not to recommend the Council to advance more than £1,000,000 during the current financial year. It was intended to give first consideration to applications for loans for the completion of works for which loans had already been granted, and next to consider requests for loans required for obligatory services, such as sewers, electric lighting mains, and works necessary to meet statutory obligations. The Committee recommended that a copy of its report should be sent to each of the local authorities. After an amendment to refer back had been rejected by 64 votes to 33, the proposal was agreed to. It was also decided to lend £9,357 to the Bermondsey B.C. for extensions of mains and the provision of meters.

The L.C.C. Electric Supply Bill will be discussed in the House of Commons on May 9th next.

We understand that the Electric Supply Bill has been much unde discussion by the Council during the past few weeks. It has been stated that an understanding has been arrived at in regard to the Bill, as to which the following main points are of interest:—

Second reading of the Bill to be proceeded with, certain clauses being deleted.

A new clause to be inserted when the Bill reaches committee stage in Parliament, giving the Council powers to purchase within a certain period existing undertakings, in the event of the Council's failing to arrive at an agreement with the companies for the future working of those undertakings on lines to be approved by the Council.

Proposed coalescence of existing undertakings for the purpose of uniform working throughout London.

The companies to provide four generating stations to serve the metropolis—one in the east, one in the west, one in the south, and one in the north.

Maximum of 1d. per unit to be charged by the companies.

Other conditions to safeguard the public interests.

The consideration to the companies to be an extension of the time within which their undertakings cannot be acquired except by expropriation.

Under no circumstances will the present Council work the undertaking itself.

At the time of going to press we gather that the course to be adopted at the second reading of the Bill is still undecided, and the Bill may possibly be dropped.

In regard to the Greenwich power station, it is proposed to expend a further £500,000 upon it, and to use it for tramway supply exclusively.

WOOLWICH.—At the meeting of the B.C. on April 25th, Messrs. Whistler & Worge, of Eltham, builders and electrical engineers, were appointed to carry out installation work on behalf of the Council in Eltham. With regard to the remainder of the borough, *i.e.*, the parishes of Woolwich and Plumstead, the Council is to invite applications by advertisement. It also decided to generate wholly from coal at the Plumstead works for one month, in order to obtain exact data as to the comparative cost of generating respectively by coal, and by coal and refuse combined; this step is due to the increase in the cost of destructor steam generated from refuse for electricity purposes, from 0·25d. to 0·6d. per unit sold. The B.C. has agreed to provide the small synchronous motor-generator recommended by Sir Alexander Kennedy, in order to at once diminish the excessive working costs for the supply to the Eltham district on light loads, by being able to discontinue the use of the two high-tension 500-KW. steam units at Plumstead.

CAMBERWELL.—The General Purposes Committee of the B.C. has decided to appeal to the B. of T. on the matter of the dispute between itself and the County of London Electric Supply Co., as to the laying of mains in the area other than those for supplying the area with electricity.

Maldens and Coombe.—The B. of T. has issued a prov. order for E.L. to the County of London Electric Supply Co. for the area.

Middlesex.—The C.C. has decided to take no action in regard to the resolutions adopted by the Edmonton and Wood Green Councils asking the C.C. to promote a Bill for the supply of electricity in bulk on the lines of the L.C.C. Bill.

Northumberland.—The Harton Coal Co. is being provided with an electrical equipment, including 15 three-phase motors. Eleven of these are for driving haulage and winding plants, while the remainder are for driving pumps and air compressors. Four 120-B.H.P. motors are being installed for winding, &c., seven others of 80 B.H.P. each, also 120-B.H.P. motors for other purposes.

Otley.—The B. of T. has given notice of the revocation of the Otley Electric Lighting Order, 1902, as from April 12th last.

South Africa.—JOHANNESBURG.—The manager of the Light and Power Department, Mr. J. F. I. Thomas, has recently reported to his Committee as to the state of the new generating plant, which has proved so unreliable. From this it appears that the five sets of D.C. plant (5,400 KW.) and two sets of A.C. plant (2,025 KW.) which are erected and in use, have never all been available at once, owing to breakdowns. The producer plant is fairly satisfactory, though the gas is not altogether free of tar. Steam-driven blowers are recommended in place of electric, owing to the possibility of failure of the present motor supply, which shuts down the whole station. The producers will probably fall short of their guaranteed output; each producer is supposed to be capable of supplying sufficient gas, with a margin, to run a 675-KW. set on full load. One of the chief troubles appears to be that the sets never give anything like their full output; at the time of the report the output was 20 per cent. low. The manager adds that it has been seldom of late that two-thirds of the plant has been in a condition to run at any one time; and that the engines cannot last long under present conditions owing to the extra stress to which they are subjected through pre-ignition troubles. The pre-ignition troubles are being got over by certain alterations, but the manager expresses doubt as to whether the large sets can be remedied. The report proceeds to show that pre-ignition in one set, on heavy load, recently shut down the three sets then running in parallel, incidentally, of course, shutting down the supply. Among other defects brought to light in this document are breakdowns of pumps, bearings—due to defective lubrication, water service, and compressor plant. Under Messrs. Stewart's running contract they are entitled to charge the Council the sum of £1,000 per month plus 1·1d. per unit. The actual cost to the Council for the 3½ months ended February 28th was 1·62d. per unit (exclusive of penalties); to Messrs. Stewart it was 2·55d., or a loss of ·93d. per unit. The following analysis of the above figures is also of interest:—

	Actual cost to Messrs. Stewart for 3½ mths. to Feb. 28th 1907.	Messrs. Stewart's guarantee.	Messrs. Mordey and Dawbarn's original estimate.
Fuel	·55d.	·28d.	·37d.
Water	·10d.*	·10d.	·06d.
Oil, waste, stores	·46d.	—	·10d.
Wages	·86d.	—	·23d.
Repairs	·58d.	—	·10d.
Total works cost per unit	2·55d.	—	·86d.

* Charge made under agreement has been exceeded, and will be charged to Messrs. Stewart.

Against the loss of ·93d. per unit Messrs. Stewart obtain ·4d. per unit for tar at 8d. per gallon. The manager concludes that, even after alteration, it is unlikely that the engines will fulfil their guarantees; further that they are unlikely in any event to prove sufficiently reliable. As the plant can hardly be ready to pass any tests in June, it is suggested that Messrs. Stewart might provide some temporary plant, with a view to releasing some of the permanent plant for alterations, &c. A local paper states that the Johannesburg authorities have since the above ordered 12,000 H.P. of steam plant.

Stratford-on-Avon.—On Saturday last the local electric lighting undertaking was officially inaugurated, the opening ceremony being performed by the Mayor. The generating plant consists of Hornsby-Stockport gas engines worked from producers, and coupled to Johnson & Phillips interpole D.C. generators. A 220-cell "D.P." battery is also installed. Messrs. Johnson and Phillips were the contractors for the whole of the work.

Stoke-on-Trent.—The B. of T. has granted a prov. order to the T.C., enabling the latter to supply energy within the district of Fenton U.D.C.

Todmorden.—During the past financial year (the first year's operation) the electricity department sold 60,171 units, for which it received £696. The interest and sinking fund charges for the year amounted to £1,304, leaving a total deficiency on the year's working of £1,439.

West Bromwich.—The Corporation Electric Lighting Committee report that during the financial year ended March 31st, the number of units sold was 1,799,353, and the amount of rental was £12,871, an increase of 143,426 units and £790 in the rental over the previous year.

TRAMWAY and RAILWAY NOTES.

Belfast.—The City Council, sitting in Committee last week, approved of the purchase of the Cavehill and Whitewell tramway at £60,000, and the matter will come up for confirmation this week. In the meantime, the Citizen's Association is opposing the purchase of the system on the ground that the purchase money is too high for the undertaking, which only cost £18,000. At the meeting of the Tramways and Electrical Committee, April 29th, Sir James Henderson presiding, the report of the city accountant showed a net profit of £11,479, on the electric lighting undertaking for the year ending March 31st, the total output for the year being 9,653,709 units, lighting showing an increase of 23 per cent., and power units 36½ per cent.

Bexley.—The traffic statistics for the year ending March 31st, 1907, show that 1,737,204 passengers were carried and 268,618 car miles run, as compared with 1,677,637 passengers and 258,319 car miles run in the previous year. The receipts for the year were £11,419 or 10·20d. per car-mile, as compared with £10,541 or 9·79d. in 1906. Including rental due from Dartford, the increase in receipts amounts to £1,006.

Birmingham.—An arrangement has been come to with the B.E.T. Co. by which through cars will be run between Birmingham and Erdington, over a section of the Aston routes leased to the company. It is hoped that a similar arrangement may be come to as regards the other side of Aston, where the B.E.T. Co. and the Handsworth authorities are interested.

Bolton.—The income for the past year on the tramways amounted to £111,294, equal to 11·074d. per car-mile, while the expenditure accounts for £61,563, or 6·126d. per car-mile. According to these figures, which were presented on Tuesday evening by the borough treasurer, in his annual report to the Tramways Committee, there is a profit of £49,731, and out of it a sum of £9,077 has been voted to the relief of the rates.

The Tramways Committee has arranged to make a month's trial of a Darracq-Serpollet omnibus on its Darcy Lever route. If satisfactory, the omnibus will be purchased and a regular service instituted. The question of parcel-carrying by motor-'buses and the tramcars is also under consideration.

Croydon.—The Corporation has come to an arrangement for inter-running with the South Metropolitan Electric Tramways, between the Crystal Palace and West Croydon station, and over the Penge route to the Palace. Each party takes the earnings on its own sections, and pays the other 3d. per car-mile run on the other's route. The agreement is subject to three months' notice.

Glasgow.—The general manager of the tramways has advised the Corporation to oppose the Paisley District Tramways Order.

In connection with the additional plant required for the Pinkston power station of the Tramways Department, the Committee of the T.C. has agreed that two members of the staff, along with Mr. W. W. Lackie, chief engineer to the Corporation Electricity Department, shall visit certain Continental towns with a view of getting the fullest information on the question of turbine engines.

Huddersfield.—The financial statement for the twelve months ending March 31st shows a capital outlay to date of £412,902. The miles run were 1,804,745, compared with 1,750,650 in 1906. The income was as follows:—Passengers, £77,815; postmen, £300; parcels, £1,087; advertising, £1,122; coal haulage, £845; and sundries, £27; making a total of £81,196, or 10·79d. per car-mile, compared with £74,495 and 10·21d. in 1906. The total working expenditure amounted to £40,042, or 5·32d. per car-mile (against £39,872 and 5·46d. in 1906), leaving a gross surplus of £41,154. The rent of leased lines amounted to £1,206; interest to £12,688; and sinking fund, £9,808, leaving a net surplus of £17,452, or 2·32d., compared with £10,970 and 1·51d. in 1906. Depreciation at the rate of 3 per cent. absorbed £12,427, so that the actual surplus was £5,025, or ·67d. per car-mile, compared with a deficiency of £1,132 and ·15d. per car-mile in 1906. The sum of £5,025 was transferred in relief of the rates. During the twelve months the total number of passengers carried was 15,252,150, an increase on last year of 1,258,701.

Halifax.—The Electricity Committee has just concluded a "third party insurance arrangement" with the Law, Car and General Insurance Co., Ltd., by which it secures the following terms:—£1,000 (maximum) for any one accident, and £4,500 (maximum) for any one year, for a premium of 1s. 6d. per 100 miles run, the Corporation to have the option of renewing the policy upon the same conditions at the end of one, two or three years.

Manchester and Salford.—It is highly probable that before many weeks have elapsed, an arrangement for the interchange of tramway traffic between Manchester and Salford will be in active operation. The managers of the two tramway systems have practically agreed upon the terms of a report, which they have been requested to submit to the Tramways Committees of the city and borough. The Committees, it is understood, will recommend the running of interchange through cars for a period of several months, in order to demonstrate the utility of the scheme, before it is extensively adopted. The financial part of the arrangement will be similar to what is in force already between Manchester and Oldham, and Manchester and Ashton-under-Lyne.

Rochdale.—The T.C. has received from the B. of T. sanction to loans of £27,681 for the electrical equipment of the tramways, and £8,242 for cars.

Rutherglen.—The town clerk has communicated with the Glasgow T.C. to the effect that, in view of the opposition of the Corporation to the Rutherglen Electric Lighting Order, his T.C. will not proceed with the order this session.

Salford.—The B. of T. on the 25th ult. appointed an arbitrator between Eccles and Salford Corporations as to the amount which the latter shall offer to Eccles for electrical energy for the operation of the Salford cars in the latter place.

South Shields.—The Corporation tramways have just completed their first year of running, and the result is that the year's working shows a net profit of £4,648. The gross capital expenditure on the undertaking amounts to £155,421, which includes the sum of £20,000, being the contribution from the tramways system to the cost of the street improvements carried out in Fowler Street. The interest and sinking fund on this amount are £917. The Corporation obtained borrowing powers in connection with the undertaking for £252,170, and the amount already absorbed is £134,060, so that the powers it holds provide for the borrowing of a further sum of £118,110. During the first 12 months of the working of the system the traffic revenue amounted to £23,992, and the total revenue was £24,038. The working expenses for the same period amounted to £12,138, leaving a gross profit of £11,901 on the year's working. This is equal to 7·66 per cent. on the capital expenditure. The sum of £4,394 is required for interest on capital and £2,858 for sinking fund charges; the net profit for the year being as mentioned above. It is proposed to place the sum of £2,530 to the reserve fund, and £2,117 will be absorbed to wipe off the deficiency recorded in the books of the department at March, 1906, mainly for interest and sinking fund charges during the construction of the system. The average revenue per car-mile was 10·28d., and the total revenue per car-mile was 10·30d. The number of car-miles covered during the year was 559,946. The total number of passengers carried was 5,924,929. The average working expenses per car-mile, excluding power costs, were 3·38d., and the average cost of power per car-mile was 1·82d. The total number of units consumed was 710,234.

Walthamstow.—The U.D.C. has decided that the charge for energy supplied to the tramways shall be fixed at 1⅝d. per unit for the 12 months ended March 31st, 1907, and that for the current year a charge of 1¾d. per unit be made, subject to revision at the end of the financial year.

Wimbledon.—Cars began to run on Saturday last on the New Malden to Raynes Park section of the L.U.T. Co.'s line, which is about 2½ miles in length, and was finished about a year ago.

TELEGRAPH and TELEPHONE NOTES.

Hull.—A report on the year's working of the Corporation telephone system was submitted to the Corporation Telephones Committee last week. The revenue for the year amounted to £8,989, out of which had been paid: repairs, £1,200; wages, £1,959; rents, £637; Government royalty, £910; other expenses, £136. The total, £4,842, left a balance of £4,147. Out of the balance during the year there had been paid in interest £1,527, and sinking fund £1,231, leaving a net balance of £1,389.

Manchester.—The Corporation has received a memorial appealing for a reconsideration of the claim of the New Mutual Telephone Syndicate, Ltd., for compensation, signed by a number of firms and by the Secretary of the Chamber of Commerce.

Trunk Telephone Lines.—Two additional trunk telephone lines between Southampton and London are to be brought into use in the next few months. Additional lines to Portsmouth, Bournemouth, Salisbury, and the Isle of Wight from Southampton are also being provided.—*The Times.*

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Cayenne-Pinheiro	Aug. 13, 1902	..
Curacao-Coro	Closed..	..
Curacao-La Guayra	Jan. 12, 1906	..
Curacao-Maracaibo		
Reissa-Issa and Reissa-Yemani (Yemen)	Oct. 22, 1902	..
Tarifa-Tangier	Jan. 18, 1904	..
Port Arthur-Chifu (Closed)	Mar. 9, 1904	..
Garachico-Santa Cruz	July 12, 1906	..
Las Palmas-Arecife	Aug. 18, 1906	..
New Brunswick-Prince Edward Island	Jan. 9, 1907	..
Cadiz-Teneriffe	April 10, 1907	..
Dakar-Conakry	April 24, 1907	..
Landlines.		
Puerto-Barrios	Aug. 28, 1902	..

Wireless Telegraphy.—The international agreement which, as already reported, has been concluded between the representatives of France, England, Germany and Spain on the one hand, and M. Henri Popp on the other, has been followed by the publication of interesting details respecting this arrangement for the establishment of wireless telegraphy in Morocco. It appears that the equipment and working of the system will be taken over by the international company, which is to be constituted with a share capital of £60,000, which will be subscribed in equal parts by the four nationalities. The sum of £10,000 out of this total amount will serve for the purchase of the existing equipment of the wireless stations at Tangier, Saffi, Casablanca and Mogodore, whilst the remainder is intended for the working of these stations and the erection of others. The contracts for deliveries for these latter are to be divided into equal parts in such a way that the equipment already supplied of the value of £10,000 will be considered as the French share, and the three other nations will now be entitled to claim contracts for apparatus of a similar value in each case. The new international company will have an administrative council composed of two representatives of each of the four interested countries, with M. Henri Popp, engineer, as manager of the company, and it is stated that his ultimate successor will also be of French nationality. The second manager will, however, be representative of another country, and will be appointed by the administrative council. It is provided that the selection and appointment of the company's officials shall also take place under a similar participation of the four nations. According to the agreement of Algeciras, the company will, in the first place, seek the concession for the establishment of wireless telegraphy in the four coast towns already mentioned, and afterwards the erection of further stations at Marrakesh, Fez, Larache, Masagan, and generally at all the important places in Morocco, in order to cover the whole country with a "network" of wireless telegraphy. The scope of transmission from the stations at Tangier and Saffi is to be increased to a distance of 930 miles seawards, so as to be able to reach all vessels travelling in a northerly or southerly direction along the Atlantic coast. The agreement has been concluded with M. Henri Popp as the builder of the four stations in course of completion.

CONTRACTORS' COLUMN.

Openings for New Business.

ABERAMAN (Aberdare).—Public hall (£7,398). J. Morgan & Sons, Ltd., builders, 53, Monk Street, Aberdare.

ALNWICK.—New infirmary. Jas. Wightman Douglas, architect, 1, St. Nicholas Buildings, Newcastle-on-Tyne. Messrs. Elliott, Preston, builders.

BARNSLEY.—Three warehouses. P. A. Hinchliffe, 14, Regent Street, Barnsley.

(Darton).—New public schools (£2,850). Crawshaw & Williamson, Regent Street, Barnsley.

BATLEY.—Enlargement of Girls' Grammar School (£2,300). Plans approved by Education Committee.

BOLTON.—Extensions to Raike's Bleach Works. J. W. Taylor, Raike's Bleach Works, Bolton.

BOURNEMOUTH.—Hall for St. Peter's Parish. H. E. Hawker & Mitchell, architects, St. Peter's Chambers, Bournemouth.

BRADFORD.—Additional plant wanted for the workhouse. The Engineer, Bradford Poor Law Union, 22, Manor Row, Bradford.

BRISTOL.—Extension of Nurses' Home at the General Hospital (lit by electricity).

Additions to London and South-Western Bank. H. Williams, architect, Alliance Chambers, Corn Street, Bristol.

BURNLEY.—New theatre (seats 2,500). Palace and Hippodrome Co. Solicitor, F. W. Steele, Burnley.

CARRIGLOE.—Villa residence for Lord Barrymore. W. H. Hill & Son, 28, South Mall, Cork, architects.

CHINGFORD.—Sorting office. J. Wager, H.M. Office of Works, Storey's Gate, S.W.

COVENTRY.—New motor and cycle factory. E. O'Brien, Ltd., owners.

DALKEITH.—New railway station. Railway Company's Architect.

DEVONPORT (Keyham).—New Church, St. Thomas-the-Apostle (£4,250). Hine, Odgers & May, architects; Matcham & Co., Ltd., builders, 6, Addison Road, Plymouth.

DONCASTER.—Extensions to Post Office, including sorting buildings.

DOVER.—New secondary schools to be built by the T.C.

EXMOUTH.—Buildings in Victoria Road for Y.M.C.A.

HALIFAX.—New public schools at Shelf. J. Vickers-Edwards, architect, Wakefield.

HELENSBURGH.—Series of large villas. Mitchell & Whitelaw, architects Glasgow.

HAMILTON.—Central offices for Lanarkshire Miners' Union (£3,000). Secretary, Union, Hamilton.

HANLEY.—Parsonage House (St. Jude's Parish). R. Scrivener & Sons, architects, Howard Place, Hanley.

ILFORD (Uphall).—New public school. H. & E. Harris, builders, Hampton.

KEIGHLEY.—Ironworks workshop. Keighley Ironworks Society, Ltd., Keighley.

KENDAL.—Westmoreland County Hospital (lighting and power installation required). John F. Curwen, 26, Highgate, Kendal.

LANCHESTER (Near Durham).—Workmen's club and institute. T. E. Taylor, architect, Prospect House, Lanchester.

LIVERPOOL.—Public baths at Queen's Drive, Walton. W. R. Court, engineer and chief superintendent, Municipal Offices, Liverpool.

LLANDOVERY.—Residence, stables, &c., for Mr. J. F. Rees. A. S. Williams, architect, Llandilo.

LONDON (Bedford Park, W.).—Enlargement of Acton and Chiswick Polytechnic (£8,275). County Surveyor, Middlesex Guildhall.

(Streatham).—Additions to St. Margaret's Church, Barcombe Avenue, Streatham, S.W.

(Greenwich).—Workshops, &c. Scott, Hanson & Fraser, 10, Basinghall Street, E.C., architects.

(Kensington).—Additions to R.C. church in High Street. Canon Michael Fanning, 1, Leonard Place, Kensington Road, W.

(Westminster).—Infants' hospital, Vincent's Square. Major-General Lord Cheylesmore, 16, Prince's Gate, S.W., chairman of Committee.

(Strand).—Rebuilding offices British Medical Association and *British Medical Journal*. Prestige & Co., Pimlico, S.W., builders.

(Deptford).—Extensions to works of J. Stone & Co., Ltd., engineers.

(Hampstead).—Additions to schools. Beazley & Burrows, 17, Victoria Street, S.W., architects.

(Dartford).—Workshops at Darenth Asylum (£2,970). Hyde and Co., Norwood Junction, S.E., builders.

(Lewisham).—Rebuilding warehouse and office buildings. A. W. Osborn, 3, Railway Approach, Lewisham, S.E., architect.

(Lewisham).—Sorting office for Postmaster-General. F. & G. Foster, Norwood Junction, builders.

(Clapham).—Hall, schoolroom, &c., in Clapham Park Road, at corner of Park Hill.

(Blackfriars).—Rebuilding of Hospital for Skin Diseases (£10,000). G. A. Richardson, secretary.

(W.).—Building at corner of Oxford Street and Bird Street. May and Rowden, 27, Maddox Street, W., agents.

(Whitehall, S.W.).—Rebuilding H.M. Office of Woods and Forests, and other Government offices, at 1 and 2, Whitehall Place and 1, Whitehall. H.M. Board of Works, Storey's Gate, S.W.

MANCHESTER.—New block of warehouses and offices, corner of Old Millgate and Hanging Ditch. Contractors, Robt. Neill & Sons, Strangeways, Manchester.

Block of warehouses and shops, fronting Thomas Street. Contractors, Peace & Norquoy, New Islington, Manchester.

New packing warehouse in Princess Street. Architect, J. R. E. Birkett, 4, Albert Square, Manchester.

New municipal school in City Road (£17,850). Contractors, Messrs. H. Vickers & Sons, Manchester.

New Congregational church at Irlams-o'-th'-Height, Pendleton. Architect, E. Hewitt, F.R.I.B.A., 35, Brazennose Street, Manchester. Builders, J. Chapman & Sons, Patricroft.

MIDDLESBROUGH.—Additions and alterations to North Ormesby Hospital. J. M. Bottomley, Son & Wellburn, architects, 28 and 30, Albert Road, Middlesbrough.

MONAGHAN.—Laboratories, dormitories, &c., at St. Macarten's Seminary, for Rev. T. O'Doherty, President. J. J. M'Donnell, Architect, 27, Chichester Street, Belfast.

NOTTINGHAM.—General Post Office to be extended (£5,000).

OLDHAM.—New spinning mill at Springhead, for the Rome Spinning Co. Contractor, E. Stephenson, Oldham.

(Lees).—New spinning mill. Contractor, Mr. Edward Stevenson, Oldham.

Extension of mill (36,000 more spindles). Secretary, Monarch Spinning Co., Oldham.

PETERBOROUGH (Lincoln Road).—New school. Mr. A. W. Ruddle, architect, Cathedral Gateway, Peterborough.

PRESTON.—Weaving shed (620 looms). Taylor Bros., Manchester and Bolton.

REIGATE (Hooley).—New public school (£7,650). Hooper & Son, architects Redhill.

ROCHDALE (Spotland Bridge).—New Police Station, to be built by T.C. (Cost, £1,750.)

(Oakenrod).—Public schools (500 scholars). Sykes & Evans, architects, Manchester.

SCARBOROUGH.—Theatre at the Aquarium, lit by electricity. C. Edeson, architect, Scarborough.

SHEFFIELD (Crookes).—New Wesleyan Church and Hall (£9,000). W. J. Hale, architect, 18, St. James Row, Sheffield.

SHIPLEY.—Queen's Palace of Varieties. Empsall & Clarkson, architects, 7, Exchange, Bradford.

SMETHWICK (Birmingham).—Wesleyan Sunday Schools (£2,000). Ewen, Harper & Brother, architects, 191, Corporation Street, Birmingham.

76 houses and shop. Goodwin & Jennens, builders, Smethwick.

SWINTON (Manchester).—New weaving shed. S. Rawlinson, builder, Swinton.

THAMES HAVEN.—Three warehouses, transport sheds, &c., for London and Thames Haven Oil Wharves, Ltd., 101, Leadenhall Street, E.C.

WIGAN (Standish).—New Primitive Methodist Schools. W. H. Dinsley, architect, Chorley; Bywater & Sons, builders, Pemberton, Wigan.

WINDSOR.—New King Edward VII Hospital.

Hill-Climbing Test of the B.T.-H. 'Bus.—The British Thomson-Houston Co., Ltd., have entered their new petrol-electric 'bus for the Frome's Hill climb organised by the Herefordshire Automobile Club for to-day, 3rd inst. While it cannot be expected that a heavy commercial vehicle can secure an award in such a competition which is primarily open to touring cars, it is interesting to note that this company's petrol-electric vehicle can successfully negotiate a grade of the magnitude of Frome's Hill, which is 1289 yards long and has an average gradient of 1 in 11·22 and a maximum gradient of 1 in 6·37.

CONTRACTS OPEN and CLOSED.

OPEN.

Antwerp.—May 6th. The municipal authorities of this city invite tenders for the supply of electric lift and crane appliances. The specification may be obtained from the Hotel de Ville, at Antwerp. Tenders, in sealed registered envelopes, should be delivered to "M. le Bourgmestre de la Ville," at the Hotel de Ville. Deposit 3,000 francs (about £120). Specification at the Commercial Intelligence Branch, Board of Trade, 73, Basinghall Street, E.C.

Aston Manor.—May 11th. High and low-tension three-phase cables for lighting supply to Erdington U.D. See "Official Notices" April 26th.

Barnes.—May 14th. Steam, exhaust and other piping for the electricity works. See "Official Notices" April 26th.

Belgium.—May 18th. The municipal authorities of Brussels are inviting tenders for the supply and erection at the gas works, of four static transformers, two 60-K.V.A. alternators, 18 synchronised motors, &c. Particulars may be obtained from, and tenders are to be sent to, Le Collège des Bourgmestre et Echevins, Hotel de Ville, Brussels.

Belgium.—May 24th. Tenders are required for the installation of electric light in the Royal Museum of Antiquities and Armoury at the Porte de Hal by May 24th. A deposit of £20 is required. Specification No. 38 at 3d. and plans at 1s. 7d. may be obtained at 15, Rue des Augustins, Brussels. Tenders are to be addressed to the Directions, Générale des Ponts et Chaussies, 38, Rue de Louvain, Brussels.

Belfast.—May 11th. Coal for the Tramways and Electricity Department for one year.

Bristol.—May 20th. A.C. and D.C. flame arc lamps for the Corporation. See "Official Notices." April 26th.

Cambuslang.—May 22nd. 70-KW. motor-generator: A.C. and D.C. switchgear; battery and booster for the electricity works extensions. See "Official Notices" to-day.

Colne.—May 13th. 360-KW. D.C. dynamo and Belliss engine; Lancashire boiler with superheater, for the Electrical Committee. See "Official Notices" to-day.

Croydon.—May 6th. Boiler feed pipe-work and new flue and economiser setting at the Council's electricity works. See "Official Notices" April 26th.

Ealing.—June 1st. One water-tube boiler for the electricity works. See "Official Notices" to-day.

France.—May 15th. Tenders required for the construction of the section from the St. Lazare Railway Station to the Place Pigalle of the underground electric railway from the Porte de Versailles to the Place Jules Joffrin. Tenders will be opened on May 15th at 4 p.m. at the offices of the Société du Chemin de Fer Electrique Souterrain Nord-Sud de Paris, 20, rue d'Athènes.

Gravesend.—May 10th. Cables, battery, balancer and booster, and switchboard for the Electricity Committee. See "Official Notices" April 26th.

Islington.—May 8th. Electrically-driven fan for the Lighting Committee. See "Official Notices" April 12th.

Kirkcaldy.—May 4th. Boiler feed pump (3,000 gals. per hour) for the Corporation Electricity Works. See "Official Notices" April 19th.

L.C.C.—May 7th and June 11th. Six fuel economisers for East Greenwich tramways generating station; high and low-tension switchgear for five tramway sub-stations. See "Official Notices" April 26th.

L.C.C.—May 14th. Electric light and bell installation, &c., for Westminster Technical Institute. See "Official Notices" to-day.

Manchester.—May 16th. Washed coal slack for the Electricity Committee for one year.

Melbourne (Victoria).—May 7th. Tenders will be received at the office of the Deputy Postmaster-General, Melbourne, for the supply and delivery at Melbourne of two telephone switchboards. See this column in our April 5th issue.

New Zealand.—June 1st. The Wanganui Town Council requires tenders for materials for about six miles of electric tramway track with all plant, machinery, cars and apparatus for working of the tramway. Particulars may be obtained from the Town Clerk.

(Concluded on page 729.)

ELECTRIC POWER IN DURHAM COLLIERIES.

(*Concluded from page* 685.)

THREE of the underground sub-stations at the Lambton "D" pit also form compressor houses (see fig. 10), and house air compressors of the Ingersoll type, belt-driven in each case by 150-H.P. Peebles enclosed ventilated induction motors with the same firm's metallic controllers, adapted specially for this work. The fourth sub-station, which is 1,700 yds. "in-bye," supplies sundry small motors for pumping, coal-cutting, &c., and also local lighting. In each of these sub-stations an oil-cooled transformer is installed, reducing the primary pressure of 6,500 volts to 500 volts for the three-phase supply to the motors. The switchgear is all of the oil-break type, and accords with the Home Office regulations governing the use of electricity in mines.

Among the smaller motors in "D" pit is a 10-H.P. Peebles machine, driving a small haulage for handling empty tubs. In addition to the compressors, the underground sub-stations already mentioned, supply the above small haulage and four 7½-H.P. plunger pumps, the latter being driven by Peebles motors of a special design. These motors are of a particularly interesting type, being fitted with the Peebles automatic starting mechanism, so that they can be started against full load torque by simply closing a switch, and are thus independent of controller operation, a most important point when, as in the present case, thoroughly skilled labour is seldom available. The lighting of the engine planes, roads, stables, &c., is supplied from a 50-KW. transformer in the surface sub-station, which gives a secondary voltage of 380 between phases, or approximately 220 to neutral, which thus comes within the limits of low pressure, according to the B. of T. regulations.

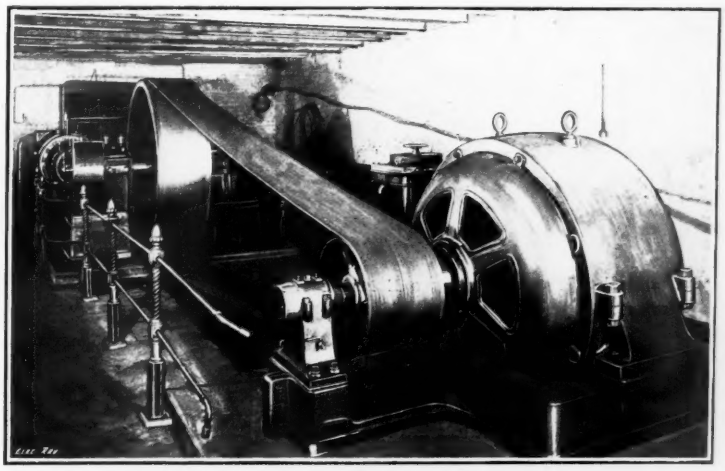


FIG. 10.—UNDERGROUND COMPRESSOR HOUSE, "D" PIT: 150-H.P. PEEBLES MOTOR IN FOREGROUND.

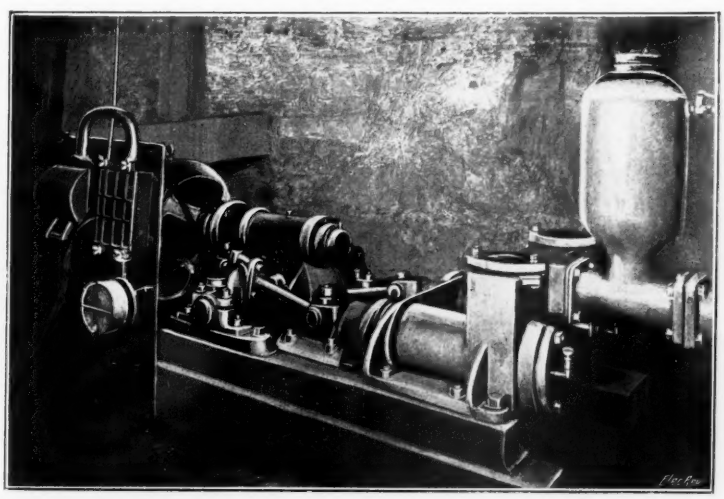


FIG. 11.—MOTOR-DRIVEN PLUNGER PUMP, FITTED WITH PEEBLES AUTOMATIC STARTING GEAR.

The surface sub-station at the Lady Ann pit contains two 175-KW. transformers, in addition to the necessary high and low tension switchgear, &c., and energy is carried down this pit by one high-tension and one low-tension cable. The latter is of ·5 sq. in. section, and carries 500-volt current to a special disconnecting Y box in the Five Quarter seam, from which one cable runs to the Brass Thill seam, and the other supplies main and subsidiary haulage engines in the Five Quarter seam. The main haulage, the mechanical part of which was supplied by Messrs. Bever Dorling & Co., is driven through double reduction cut gearing by a Peebles 100-B.H.P. three-phase motor, which has an overload capacity equivalent to 200 B.H.P. for short periods. The drums of the gear are 5 ft. in diameter, and the rope speed normally 8 miles an hour. An interesting item of this equipment is the special haulage controller, of the liquid type, constructed by Messrs. Bruce Peebles. By the aid of this controller it is possible to run the haulage at any speed from "creeping" upwards, and for any length of time. The possibility of using this controller at "creeping" speed is most useful in cases where tubs have run off the rails, and must be hauled back to them. As a matter of fact, however, owing to the absolute steadiness of an electric haulage gear fitted with such a controller, the probability of tubs running off the rails is very much reduced, and so also is the

amount of coal shaken off the tubs during the haul. The duty of this main haulage gear is to haul 50 to 60 tubs per journey, weighing 15 cwt. per tubfull, and 5 cwt. empty, up a road 1,500 yards in length, and having an average gradient of 1 in 16, and a maximum of 1 in 9. A 2-KW.

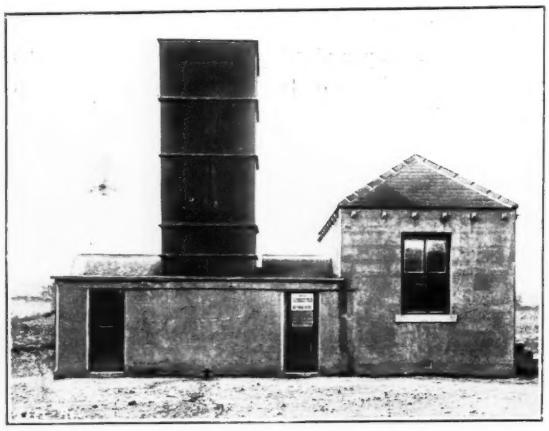


FIG. 12.—FAN HOUSE, CONTAINING ELECTRICALLY-DRIVEN SIROCCO FAN.

transformer in the haulage chamber provides for local lighting. The auxiliary haulage previously referred to, serves to pull the empty tubs up a slight gradient to the main haulage, and is driven by a 10-B.H.P. Peebles squirrel-cage motor. It has a single drum 2 ft. diameter, and the rope speed is 1½ to 2 miles per hour.

612 ft. head. Provision is made in the same chamber for a duplicate pump, and one great advantage of the system will be recognised from our view, which shows the whole set to occupy certainly less than a quarter of the space which an old style plunger pump would have required. How great a saving can thus be effected in the matter of excavation, will be realised by all practical colliery men. It may be mentioned that this turbine pump replaces a ponderous old shaft pump of the spear-rod type, driven by a vertical beam engine. It is understood that the cost of running the old pump was nearly £3,000 a year, so that the great saving will be obvious. We are enabled to reproduce views of the old and the new pump, and the contrast cannot fail to strike our readers. Another 2-KW. lighting transformer in the pump chamber supplies the lamps in the Brass Thill and Low Main seams.

The Lumley pit has at bank a sub-station containing a 250-KW. transformer, and one high and one low-tension cable are run underground, provision being made for extensions at a later date. The H.T. cable feeds a 100-KW. transformer about 1,100 yards inbye, and low-tension cables connect to the coal cutters at the working face, a distance, at present, of about 500 yards. A cable is also run to a 100-B.H.P. Peebles motor, driving a haulage which is a replica of that installed at the Lady Ann pit. For lighting, a 6-KW. transformer is installed, which suffices for the Five Quarter, Main Coal, and Low Main levels, engine planes, stables, &c. In the Brass Thill seam a low-tension cable runs about 2,250 yards inbye to gate-end boxes, from which coal cutters draw their supply through trailing cables.

One of the most interesting motor applications of the whole extensive installation is located 170 yds. from the Lumley surface sub-station, and fed by low-tension cable. This is a 55-in. double inlet Sirocco fan, driven by a Peebles patent two-speed motor of 62·5 or 125 B.H.P.,

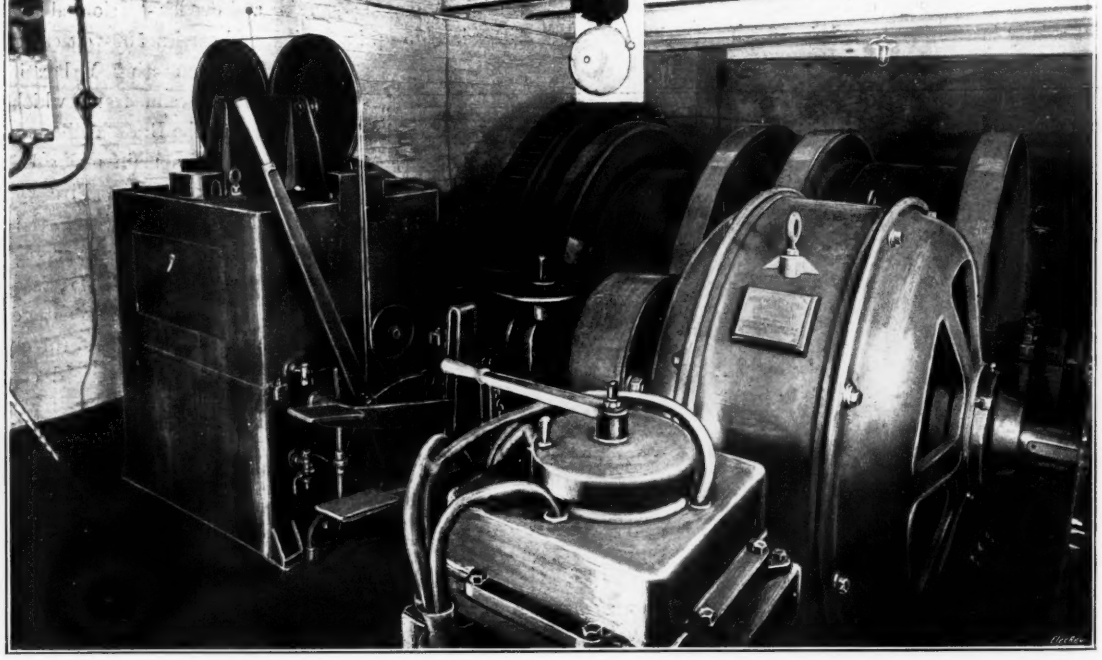


FIG. 13.—UNDERGROUND HAULAGE, EQUIPPED WITH 100-H.P. PEEBLES INDUCTION MOTOR AND LIQUID CONTROLLER.

A fine 190-B.H.P. high-speed motor-driven turbine pump is installed in the Brass Thill seam. This pump, which is illustrated in fig. 14, is direct driven at 1,440 R.P.M., by a Peebles totally-enclosed induction motor of the slip-ring type, and lifts about 700 gallons per minute, against

running at 183 or 365 R.P.M. as required. The fan has a capacity of 145,000 cb. ft. per min., against a water gauge of 2½ in., and serves to ventilate the Five Quarter, Low Main and Brass Thill seams.

It is a sign of the confidence now felt in electrical driving,

that such important work as fan-driving should be entrusted to it; and, in point of fact, the number of electrically-driven fans is rapidly increasing. We are able to reproduce photographs of the exterior of the fan house (fig. 12), and also of the motor driving same, which is of the squirrel-cage pattern, with Peebles-La Cour patent two-speed winding.

Space only allows of brief reference to the remainder of the installation. At the Margaret pit a number of continuous-current motors, supplied from small auxiliary dynamos in the Durham Collieries power station, are utilised to drive haulages, coal-cutters, pumps, &c. Most of these motors have been at work for some considerable time. From the Margaret surface sub-station, one high-tension and one low-tension cable are carried down the pit. The high-tension cable will eventually supply, through a transformer in the Deep Hutton seam, several large motor-driven pumps, which are now being installed. The low-tension cable is for lighting only, and feeds a 20-kw. 500/110-volt transformer, which supplies all the lighting.

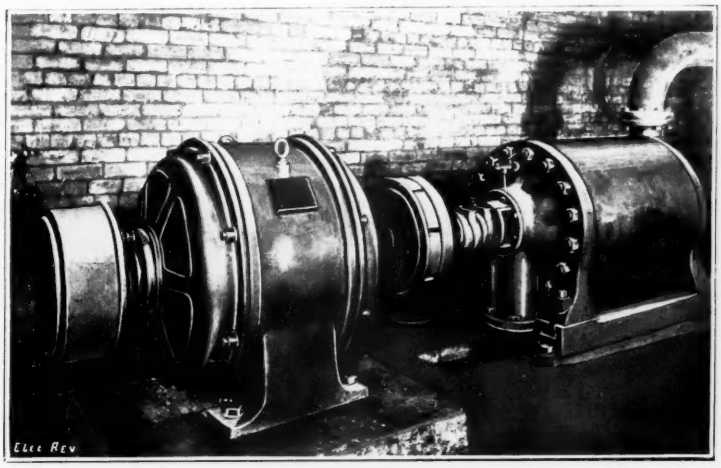


Fig. 14.—Turbine Pump, driven by 190-b.h.p. Peebles Motor.
Capacity, 700 gals. per m. against 612 ft. head; speed, 1,440 r.p.m.

Fig. 15.—150-h.p. Two-speed Peebles Induction Motor for Fan Driving.

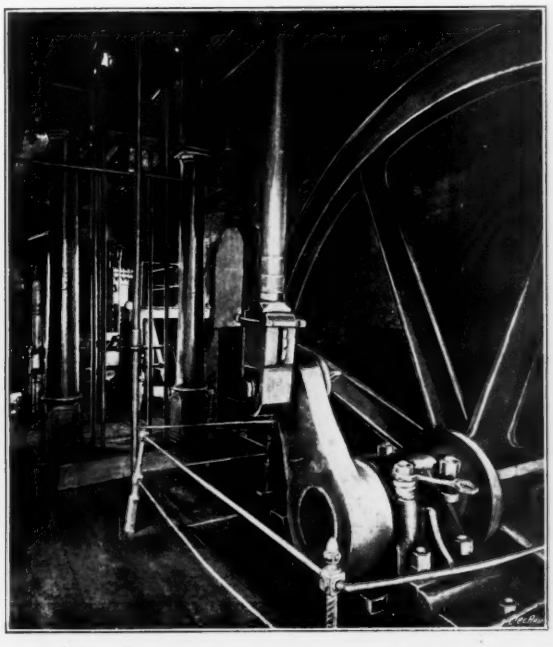


Fig. 16.—Beam Pumping Engine Superseded by Electrically-driven Turbine Pump Shown Above.
This engine was built in 1852; speed, 5 r.p.m.; coal consumption, 20 tons per 24 hours.

In conclusion, we believe the Lambton installation to be among the most comprehensive in this country; and the fact that it is being extended is an eloquent testimony as to its satisfactory operation.

Congratulations are due, not only to the progressive management of the concern in question, but also to Messrs. Bruce Peebles & Co., the contractors for the whole of the electrical equipment.

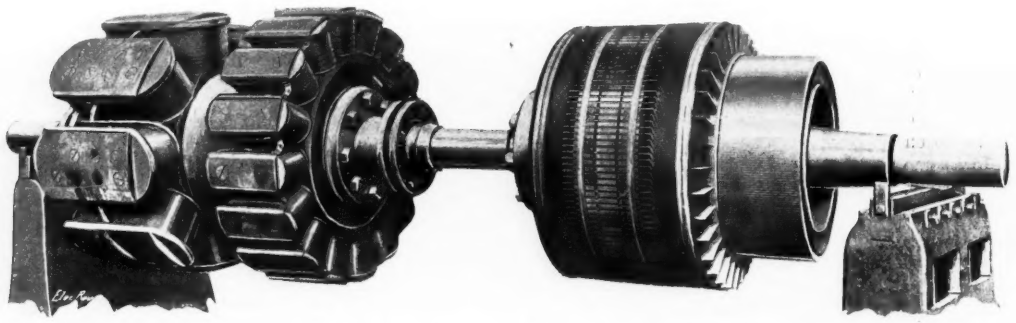
Mr. Maurice Georgi acted throughout as consulting engineer on behalf of the Lambton Collieries. Our acknowledgments are due to Mr. A. Kirkup, the agent for the Lambton Collieries, who was intimately concerned with the work of electrification throughout, and by whose kind permission the present article is published; we are also indebted to Mr. Fisher, electrical engineer to the collieries, for much information.

Car Rheostats.—A short practical article in the *Street Railway Journal* touches the best position under the body for grid rheostats, and the ways in which wrong connections may be avoided. Unless some position can be found where mud and water or dust is not blown by the wind and splashed by the wheels, the underside of the car-body is no place for rheostats. It is, indeed, difficult to know what to do with them for the best results, as they make passengers uncomfortable if placed under the seats. Possibly they might be attached to the back of the stairs in such a way as to be harmless, well ventilated, and sufficiently water and dust-proof. Sometimes they have been put in fire-proof ventilated lockers on the platforms, but they take up a good deal of valuable room. Great trouble was experienced on more than one British tramway during the past winter through the failure of resistances and other electrical apparatus, which were attached under the floors of the cars, so that briny slush was thrown over them. The careless and crude way in which car-wiring is done never ceases to astonish us, and the absence of continual fires supplies the best possible proof that electricity is safe even under the most unfavourable conditions. It is not wise on that account to make no attempt to improve those conditions, for depend upon it, the usual slipshod methods increase the repair shop staffs by no inconsiderable amount.

TRIPLE MOTOR-GENERATORS, HAMBURG METROPOLITAN AND SUBURBAN RAILWAY.

By Dr. ALFRED GRADENWITZ.

THE power station of the Blankenese-Ohlsdorf line of the Hamburg Metropolitan and Suburban Railway is designed for generating single-phase alternating current of 25 periods for operating the railway, alternating current of 50 periods for lighting, and direct current for exciting the alternators and operating some auxiliary machines.



VIEW OF THE ROTOR, TRIPLE MOTOR-GENERATOR, HAMBURG METROPOLITAN AND SUBURBAN RAILWAY.

In order to ensure, as far as possible, economical operation, a combination between the three circuits was provided for by installing two converter sets, which, by means of the surplus power of any one of the three circuits, are able to assist the others. Each of these converter sets, constructed by the Felten and Guilleaume Lahmeyerwerke A.G., comprises three machines coupled together, viz., a direct-current dynamo, an alternating-current dynamo of 25 periods, and another of 50 periods, each of which, according to circumstances, will work either as a generator or motor. The three following cases had to be taken into account :—

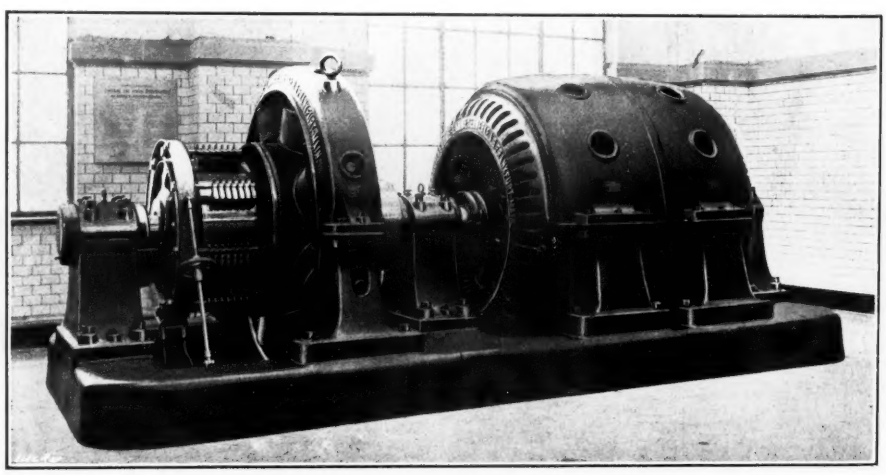
1. The 25-period machine receiving energy from the busbars of the railway circuit, operates as a motor, driving the 50-period and direct-current machines as generators; the alternating current generated is then supplied to the lighting circuit, while the direct-current is utilised in charging accumulators.

2. With the 50-period machine working as a motor, the 25-period machine supplies energy to the railway circuit, while the direct-current machine is again used for charging the battery.

3. The direct-current machine can be driven from the battery as a motor, and is used mainly in synchronising the two alternators.

In order to reduce as far as possible the space requirements of the three machines, the rotors of the two alternators, as seen in our views, are mounted on a common shaft close to each other, so that their housings are located on the baseplate without any intermediary space. The alternator shaft is coupled by a rigid clutch to the shaft of the direct-current machine and there are only three bearings required for the whole set, the aggregate length of which is about 6 m. As the speed has been taken at 375 R.P.M., the 25-period machine had to be designed with 8 poles and the 50-period machine with 16 poles.

The two alternators of one of the converter sets are able, when working as motors, to yield 900 (metrical) H.P. each, or 600 KW. at 6,300 volts pressure when operated as generators. The direct-current machine is designed for an output of 250 KW., with 220 volts pressure, while giving 375 H.P. as a motor. As regards the alternators of the smaller set, the 25-period machine will yield 250 KW. (with 6,300 volts pressure) or 380 H.P., and the 50-period machine, 150 KW. or 200 H.P. The size, output and speed of the direct-current machine are the same as in the large converter set.



TRIPLE MOTOR-GENERATOR, HAMBURG METROPOLITAN AND SUBURBAN RAILWAY.

CONTRACTS OPEN.

(Continued from page 724.)

Pembroke.—May 4th. High speed engine, dynamo, switchboard and instruments, accumulators, boiler, arc lamps and gear, and arc lamp-posts for the U.D.C. See "Official Notices" April 19th.

Queensland.—June 24th. The Postmaster-General's department at Brisbane requires tenders for 20 miles insulated wire, 5 miles lead-covered wire, 15 tons 200-lb. galvanised iron wire, 10 miles fancy covered wire, 2 tons bolts and nuts, 500 wrought-iron brackets, 10,000 Acme insulators, 500 leading-in insulator screws, 300 Acme spindles ⅜-inch, 3,000 Acme spindles ⅝-inch, 500 No. 17 galvanised carriers, 144 pints Baker's fluid, 500 porcelain tubes, 10 cwt. sheet copper, 12 connecting screws, 5 tons sulphate of magnesia, 3,000 No. 2 Leclanché zincs, 500 No. 1 Leclanché zincs, 1,000 No. 2 Carporous pots, 1 ton salammoniac, 144 2-way switches, 2,000 Ericsson fuse tubes, 60 Delville microphones and fittings, 10 gross No. 2 brass terminals, and 10 gross No. 3 brass terminals.

Shanghai.—May 4th. One 800-KW. horizontal steam turbo-alternator (single-phase), with condensing plant, for the Municipal Council. See "Official Notices" April 12th.

Sophia.—May 10th. The Postmaster-General requires tenders for 14,000 kilogrammes of bimetallic wire, of 3 mm. diameter; of 2,000 kilogrammes of 2 mm. diameter, for branching; 3,000 kilogrammes of 1½ mm. diameter; and 500 kilogrammes of 1½ mm. diameter, for branching. The estimate is £12,000, and a deposit of 5 per cent. is required. Tenders are to be addressed to the Secretaire de l'Administration des Finances.

South Australia.—June 12th. The Postmaster-General requires tenders for 500 Meidinger line cells; 500 Meidinger line cups; 5,000 Meidinger line corks and tubes; 6,000 Meidinger line zincs; 6 tons of sulphate of magnesia; and 7 tons of crushed sal-ammoniac.

Spain.—May 17th. The Post and Telegraph Department requires tenders for 20,000 zinc cylinders for voltured elements. A deposit of 5 per cent. is required. Particulars may be obtained from the Administracion de Correos y telegrafos, 10, Carretas, Madrid.

Spain.—Tenders have just been invited for the establishment of an electricity generating station at Mombeltrau (province of Avila) for the electric lighting of that town and Santa Cruz del Valle.

Stretford.—May 10th. Condensing plant and accessories, switchboard instruments, and electrical connections for 500-KW. generator. Mr. T. L. Miller, 19, Brazennose Street, Manchester. (Deposit one guinea.)

St. Pancras.—May 13th. Arc lamp carbons for the Council. See "Official Notices" April 26th.

Turkey.—The administration of the Hamidié Railway Commission of the Hedjaz requires tenders for the reserve pieces required for the telegraph service of the Haifa-Eastern Medina line, a distance of 1,500 kilometres, and for the telegraph material required for 20 telegraph stations on the Madyin-Salih-Medina line, which is 400 kilometres long. Particulars may be obtained from the Public Works Department at Constantinople. No date is fixed for receiving tenders.

Walthamstow.—May 3rd. Stores for the electricity and tramway departments. See "Official Notices" April 26th.

Warrington.—May 7th. Six tramcar top-covers for the Corporation. See "Official Notices" April 26th.

Yokohama.—The Government of Japan has decided to obtain 31 electric cranes, of a capacity of 75 tons each, and two of 30 tons each, for the quays of the port.

CLOSED.

Bolton.—The Electricity Committee on Thursday last week accepted the following tenders:—

Musgrave & Son, for a 2,000-H.P. vertical steam engine.
Dick, Kerr & Co., for a three-phase alternator.
British Insulated and Helsby Cables, Ltd., for wire.
R. W. Kenyon, for casings.

Cardiff.—The E.L. and Tramways Committee of the T.C. has accepted the tender of the Electric Construction Co. for the supply of a switchboard at the docks sub-station at £243, and that of the Lahmeyer Electrical Co., Ltd., for cables at £669.

The following notes relating to the cable contract are culled from the *South Wales Echo*, for 27th ult.:—

"Tenders were then opened for cables for the same sub-station. Before these were opened, Mr. Ellis (electrical engineer) said he was almost positive that the Committee would find there would be not more than a £5 note between all the English firms tendering. The explanation of that was that the Cable Makers' Association managed these things between themselves, and certain districts in the country were allotted to certain firms.

"When the tenders had been opened, it was found that the lowest British tender was that of the British Insulated Co., at £755, but a German firm, viz., Lahmeyer Electrical Co., tendered at £668 15s.

"Alderman Jacobs moved that the British Insulated Co.'s tender be accepted. 'At all events,' he said, 'their goods are British made.'

"The Chairman: Protection, eh? (*Laughter.*)

"Councillor Stone seconded.

"Councillor Seccombe moved, as an amendment, that the German tender be accepted.

"Councillor Roberts, in seconding, said that if there was a 'ring' amongst the British firms, it was not fair tendering. It would be better to accept the foreign tender, everything else being equal.

"Mr. Ellis having read a letter from the German firm giving certain undertakings, and stating that they had a successful branch in London, Ald. Jacobs's proposition was withdrawn, and the German firm's tender was unanimously accepted."

Glasgow.—The Tramways Committee has accepted the following offers:—

D.C.C. wire.—London Electric Wire Co.
Cable hose.—Geo. M'Lellan & Co.
Car lamps.—Edison & Swan United Electric Light Co.

Halifax.—The Corporation has accepted the tender of the Chloride Electrical Storage Co., Ltd., for a regulating booster (£732) and a switchboard for use in connection therewith (£150).

Hanley.—The T.C. has accepted the tender of the British Westinghouse Co. for a 500-KW. generating set.

Huddersfield.—The Electricity Committee has accepted the tender of the Klein Engineering Co. for the supply of condensing plant.

India Office.—A repeat order has been placed with the Lancashire Dynamo & Motor Co. for the remainder of the electrical equipment of the North-Western Railway locomotive shops, Lahore. This order includes two 250-KW. Howden Lancashire sets, and a large number of motors, mostly of the variable speed type.

Johannesburg Tramways.—An order has been placed with the Lancashire Dynamo & Motor Co. for a 500-KW. generator for direct coupling to a Belliss engine.

Lancaster.—The T.C. has accepted the tender of Messrs. Green & Sons for the renewal of the remaining section of the economiser at the electricity works, at £131.

Leyton.—The U.D.C. has accepted the tender of the Tudor Accumulator Co. for repairs to the lighting battery, and for maintenance of the traction battery.

London.—MARYLEBONE.—The B.C. has accepted the following tenders for annual supplies for the electricity undertaking:—

Siemens Bros. & Co.—Rubber cables, 3/22, 15s. per 110 yards; coil, ditto, 3/20 18s. 11d.; ditto, 7/22, £1 10s.; ditto, 7/20, £1 9s.; ditto, 7/18, £2 1s. 5d.; ditto' 7/16, £3 4s. 3d.; ditto, 7/14, £4 17s. 6d.; ditto, 19/20, £3 2s. 10d.; ditto, 19/18' £4 18s. 5d.; ditto, 19/16, £7 10s. 11d.; ditto, 19/14, £11 1s. 3d.

Vigers, Sons & Co.—Meter boards, 18 in. by 15 in., 18s. per dozen; ditto, 11 in. by 15 in., 12s. per dozen; banjo boards, 21s. per dozen; batons, 11 in. by 3 in. by 1 in., 6d. per dozen.

Edison & Swan Co.—Switch holders, 12s. 6d. per dozen; tumbler switches, 10 amperes, 16s. 6d. per dozen; ditto, 5 amperes, 8s. per dozen; switch blocks, 6½ in. by 3½ in., 2s. 4½d. per dozen; ditto, 3½ in., 10d. per dozen; wall plugs, 16 amperes, 16s. per dozen; ditto, 5 amperes, 8s. 7½d. per dozen; distribution boards, 1s. 6d. per dozen; cut-outs, 10 amperes, 4s. 2d. per dozen; ditto, 5 amperes, 2s. 9d. per dozen.

Rashleigh, Phipps & Co.—Incandescent lamps, 8 C.P., £4 7s. per gross; 16 C.P., £4 7s. per gross; 32 C.P., 10s. per dozen; 50 C.P., £1 1s. per dozen; extra for frosting, 6d. per dozen lamps.

New Brotherton Tube Co.—Electric tubing, 40 and 5 per cent. discount.

Sloan Electrical Co.—Arc lamp carbons, cored, 12 in. by 18 mm., 12s. 4d. per 250 ft.; solid, 12 in. by 12 mm., 5s. 10½d. per 250 ft.; solid, 12 in. by 11 mm., 5s. 4d. per 250 ft.; solid, 12 in. by 9 mm., 4s. 2½d. per 250 ft.

British Electric Calibrated Fuse Co.—Fuses, 500 amperes, £5 14s. per dozen; ditto, 250 amperes, 16s. 6d. per dozen; ditto, 100 amperes, 8s. 6d. per dozen; ditto, 75 amperes, 8s. per dozen; ditto, 50 amperes, 8s. per dozen; ditto, 25 amperes, 4s. 6d. per dozen.

St. Helens Cable Co.—Tinned copper fuse wires, No. 36, 2s. per lb.; No. 30, 1s. 6½d. per lb.; No. 26, 1s. 6d. per lb.; No. 24, 1s. 5½d. per lb.; No. 22, 1s. 5d. per lb.; No. 20, 1s. 4½d. per lb.; No. 18, 1s. 4½d. per lb.; No. 16, 1s. 4d. per lb.; No. 14, 1s. 4d. per lb.; binding wire, No. 14, 1s. 4d. per lb.; No. 16, 1s. 4d. per lb.; No. 18, 1s. 4½d. per lb.; No. 20, 1s. 4½d. per lb.; No. 22, 1s. 5d. per lb.; Silesian tape, 2s. 6d. per lb.; black adhesive tape, 1s. per lb.

British Insulated & Helsby Cables.—Fuse wires, No. 36, 7s. per lb.; No. 30, 4s. 6d. per lb.; No. 26, 3s. 6d. per lb.; No. 24, 3s. per lb.; No. 22, 2s. 8d. per lb.; No. 20, 2s. 7d. per lb.; No. 18, 2s. 6d. per lb.; No. 16, 2s. 5d. per lb.; No. 14, 2s. 3d. per lb.

W. T. Henley's Telegraph Works Co.—Flexible wire, 35/40, silk, £1 17s. 6d. per gross yards; ditto, 70/40, silk, £2 17s. 6d. per gross yards; ditto, 35/40, glazed cotton, £1 12s. 6d. per gross yards; ditto, 70/40, £2 10s. per gross yards.

Baxter & Caunter.—Bayonet holders, 3s. 9d. per dozen; cord grip holders, 3s. 9d. per dozen; screw holders, 3s. 9d. per dozen; porcelain fuses, 2s. 3d. per dozen; ceiling roses, 2s. 6d. per dozen.

H. G. Mayer & Co.—Carbon brushes.

W. Patterson.—Dynamo brushes, 10½ in. by $\frac{17}{32}$ in. by ½ in., weight 2 lb. 3 oz., £30 per gross.

For engineer's stores, oils, &c., the tenders of the following were accepted:—G. Hatch, Ltd.; Withy & Wyatt; Wilcox & Co.; Vincent's Stores; Pryke and Palmer; Croager Bros.; F. Bird & Co.; India-Rubber, Gutta-Percha Co.; C. King & Co.; Broad & Co.; Towers & Williamson; Glenboig Fire Clay Co.; T. & W. Farmiloe, Ltd.; Tully & Straker; C. Jenkins & Co.; Anti-Attrition Metal Co.

For meters, the tenders of the following were accepted:—

Ordinary house meters, up to 500 if required, Reason Manufacturing Co.—5-ampere and 10-ampere, 240 volts and 480 volts, £1 5s. each; 25-ampere, 240 volts and 480 volts, £1 15s. each; 50-ampere, 240 volts and 480 volts, £2 each; dial units 250.

Prepayment meters, up to the number of 200 if required by the Council, Chamberlain & Hookham.—3 and 5-ampere, £3 each; 10-ampere, £3 7s. 6d. each; maintenance 5 per cent.

The B.C. has also accepted the tender of J. Westwood & Co., at £213 10s., for painting the plant at the generating station.

L.C.C.—The Highways Committee of the L.C.C. has received the following tenders for the supply of (1) track rails and fastenings, and (2) slot rails and conductor tee-rails for the tramways:—

1.—*Track Rails.*

Bolckow, Vaughan & Co. (recommended)	£16,173
Walter Scott, Ltd.	16,570
Barrow Hæmatite Steel Co.	16,731
Lorain Steel Co.	17,056
P. & W. MacLellan	18,140
Steel, Peech & Tozer	18,213

2.—*Slot and Conductor Rails.*

P. & W. MacLellan	£5,367
Frodingham Iron and Steel Co. (recommended)	5,804
Walter Scott, Ltd.	6,237
Bolckow, Vaughan & Co.	6,972
Steel, Peech & Tozer	6,985

The lowest tender for the slot and conductor rails was for Belgian manufactures, and the Committee stated that if this was accepted there would be considerable additional expenditure for inspecting and testing the rails in Belgium. The second lowest has therefore been selected.

The undermentioned tenders have been received by the Education Committee of the L.C.C. for the electric lighting and provision of bells, telephones and fittings and wiring for motors at the London Day Training College in Holborn:—

S. G. Cozens (recommended)	£1,154
Reliance Electrical Co.	1,168
Lea and Warren	1,328
Aberdeen Electrical Engineering Co.	1,358
W. Barton & Sons	1,375
W. J. Fryer & Co.	1,397
Higgins and Griffiths	1,419
T. Potter & Sons	1,432
A. W. Penrose & Co.	1,440
Seth Brothers	1,462
Vaughan and Cook	1,500
Smeeton and Page	1,554
Cowtan and Sons	1,597
Wippell Brothers and Row	1,670
Sweet Brothers	1,680
Lund Brothers & Co.	1,780
Ekins & Co., Ltd.	1,800
J. S. Cunnington & Co.	1,811
R. Brightwell	1,834
L. Sunderland & Co.	1,910
Jackson Bros.	1,920
F. A. Glover & Co.	1,950
Weston and Sons	1,981
Barlow Bros. & Co.	2,027
Foote and Milne, Ltd.	2,285

ISLINGTON.—The E.L. Committee received seven tenders for small bituminous steam coal for use at the generating station. On tests which were made as to the evaporative efficiency of the coal, the following tenders were accepted:—

Phillips & Co.—2,500 tons Mapperley small nuts (1) price per ton in Council's wagons, 12s. 11d.; (2) price per ton in contractor's wagons, 18s. 9d.; 2,500 tons Ainsley Hall peas (1) 11s. 3d.; (2) 12s. 1d.; 7,500 tons Riddings slack (1) 11s. 3d.; (2) 12s. 1d.

Charrington, Sells, Dale & Co.—6,000 tons bright screened nuts from Mapperley (1) 12s. 4d.; (2) 13s. 1d.

The tender of Messrs. Ferranti, Ltd., has been accepted for the supply of transformers to March 31st, 1908.

Manchester.—A repeat order has been placed with the Lancashire Dynamo & Motor Co., Ltd., for a 160-KW. feeder booster driven by a three-phase 6,000 volt motor.

The Electricity Committee has, on the recommendation of the Street Mains and Lighting Sub-Committee, accepted the following tenders:—

Low tension switch gear, Mr. Bertram Thomas.
High tension switch gear, Ferranti, Limited.
Cable, W. T. Glover & Co., Ltd.; Siemens Bros. & Co., Ltd.; and Callender's Cable Co., Ltd.

Marple.—The British Westinghouse Co. have received an order for their new type six-cylinder vertical tandem gas engine, for operating the Hollins Mill Co.'s mill, at Marple. This will be a duplicate of four now being delivered to the Castner-Kellner Alkali Co., at Runcorn.

Oxford.—Messrs. Bruce Peebles & Co. have secured an order for a further motor-converter from the Oxford Electric Co.

Portsmouth.—The E.L. Committee has accepted the tender of Messrs. Sperring & Co., Portsmouth, for 150 arc lamp columns.

Stockport.—A repeat order for a 500-KW. set has been placed with the Lancashire Dynamo & Motor Co. for the Corporation tramways.

Woolwich.—The B.C. has placed an order, at £162, with the General Electric Co. for alterations to plant.

FORTHCOMING EVENTS.

To-day's Events.—Friday, May 3rd. At 7.30 p.m. At Newcastle-upon-Tyne. North-East Coast Institution of Engineers and Shipbuilders. Mr. W. C. Mountain will reply to the Discussion on his Paper on "The Application of Electricity to the Driving of Pumping Machinery for Pontoons and Graving Docks."

Wednesday, May 8th.—I.E.E. (Birmingham Local Section). Annual general meeting at the works of the B.T.-H. Co., at Rugby.

At 8 p.m. Junior Institution of Engineers. At Westminster Palace Hotel. Paper on "The Theory of the Steam Turbine," by Mr. H. M. Martin, Wh.Sc., and Mr. R. H. Parsons, Assoc.M.Inst.C.E.

Thursday, May 9th.—At 8 p.m. Institution of Electrical Engineers. At the Society of Arts, John Street, Adelphi, W.C. If the discussion on Mr. Wade's paper was concluded at last night's meeting, the following paper will be read and discussed:—"Telephonic Transmission Measurements," by B. S. Cohen, Assoc. Mem., and G. M. Shepherd.

Friday, May 10th.—At 8 p.m. Physical Society. Meeting at the Physics Laboratory of the Royal College of Science, Imperial Institute Road, South Kensington. Dr. T. C. Porter—Stereoscopy with long base-line, illustrated on the screen.

THE ELECTRICAL ENGINEERS R.E. (VOLS.).

THE following orders are issued:—

Monday, May 6th.—"A" Company, infantry drill, 6.30 p.m.
Tuesday, May 7th.—"B" Company, infantry drill, 8 p.m.
Thursday, May 9th.—"C" Company, infantry drill, 7.30 p.m.
Friday, May 10th.—"D" Company, infantry drill, 7 p.m.

J. H. S. PHILLIPS, Captain, for Adjutant on leave,
Electrical Engineers R.E (V.).

NOTES.

Cost of Gas Power.—Writing to our contemporary, *Gas and Oil Power*, Mr. J. H. Leather, of the Minehead Electricity Supply Co., Ltd., says that for anthracite nuts his company are paying 29s. 11d. delivered, while at Swansea the price is 22s. 5d. per ton. With a new engine and a suction gas plant, their cost last year for fuel alone, using anthracite beans at 22s. 11d. to 25s. 11d. delivered, was ·65d., more than three times as much as our contemporary gave for cost of generation. At Walthamstow, says Mr. Leather, the cost for fuel alone is ·43d., but he cannot find another place where they generate electricity with suction gas plant for less than ·6d. for coal alone. The Editor replies that the Walthamstow coal costs are high because anthracite pressure plant, which is used there, is not economical at low loads, and states that with anything like a decent load factor the coal costs should not be more than 0·2d. to 0·25d. He adds that private generating plants are generating a B.H.P.-hour for less than 1lb. of coal, "but, of course, electric supply companies are always at a disadvantage over a private plant because of their bad load factor."

Tramway Ambulance Social.—A highly successful social gathering was held on April 18th in connection with the Leicester Tramways Ambulance Division, at the rooms of the Recreation Club. The president, Mr. T. R. Smith, A.M.I.E.E., occupied the chair, and gave a brief résumé of the work accomplished by the ambulance division. The class was first formed in May, 1905, and the division was incorporated with the St. John's Ambulance Brigade in February, 1906. Starting with 20 men, the division had steadily increased to its present membership of 37, and including six men who had resigned in the interim, it would be seen that the tramways department had 43 ambulance men, all holding certificates and qualified for rendering first aid to the injured. In Leicester they had been fortunate enough in not having a large number of accidents on the tramways, but the need of an ambulance division such as theirs would be seen when he stated that no fewer than 70 cases had received attention from the members. All these accidents, of course, did not happen in connection with the running of the trams, as the division were supplying men for duty on the cricket and football fields, while a number of accidents had been treated in the workshops at the car-depôt and power station.

Peat as Station Fuel.—It is announced that the Hanseatic Siemens-Schuckert Works, as the representatives of the well-known Berlin company, are at present engaged on the establishment of an electric lighting and power station in the vicinity of Aurich, East Friesland, which is intended to furnish a supply to a number of localities in that region, and the utilisation of peat as fuel is to play a part in connection with the scheme. In addition to ordinary coal-fired boilers, the station is to be equipped with a special type of boiler, made by the Augsburg Machine Works of Nuremberg, in which peat will be consumed without the tedious method of preliminary drying of the material, or of any other system in which a large amount of time is lost before firing the furnace.

Inland Competition in Germany.—It is stated, in the course of the annual report of the Cologne Chamber of Commerce for 1906-7, that notwithstanding the brisk employment of, perhaps, all the electrical manufacturing works, the competitive contest has assumed a regrettable form. A group of the largest firms in the electro-technical industry, under a misapprehension of the syndicate idea, has endeavoured to undersell the outsiders, whilst, on the other hand, this loss was to be equalised by excessive price demands in other places. Owing to this policy the level of prices in the district of Cologne was kept artificially low in many cases, although a sounder syndicate policy is to be expected now that these circumstances have become known in wider circles. The observations of the Cologne Chamber are not strictly accurate in regard to a syndicate, as such a combination does not really exist, whilst the other remarks refer to cases of underbidding which have already been mentioned in recent issues of this journal.

A Long Transmission Line in Italy.—The power station of the Société des Forces Motrices de Brusio, at Brusio, which is situated on the Swiss-Italian frontier, has now been in regular operation for several weeks and without any interruption in the working. The undertaking is one of the most important in the Alpine region and the energy obtained from the use of water-power is transmitted over a distance of 102 miles into the centre of the industrial district of Lombardy, where it is utilised by the Società Lombarda per la Distribuzione di Energia Elettrico. As the source of power the River Poschiavino is used, which emanates from the Poschiavo Lake, and the water is led along a channel to a catch basin, and thence to the turbines, where the pressure is said to be equal to 40 atmospheres (600 lb.). At the present time there are six turbine sets, each of 3,000 H.P., and a second batch of six will be completed in the course of the current year, when the total capacity of the station will be increased to 36,000 H.P. The system used is three-phase, and the transmission line is carried overhead *viâ* the Veltlin, the north-east bank of Lake Como, the Valsassina, Lecco and Brianza to Castellanza. The aerial line has necessitated the use of 900 tons of copper wire, and the iron masts which support the wires have absorbed 3,000 tons of iron.

Institution and Lecture Notes.—INSTITUTION OF ELECTRICAL ENGINEERS.—At the meeting, held last Thursday, the undermentioned nominations for the Council for the ensuing year were announced:—

President—*The Right Hon. Lord Kelvin.

Vice-Presidents.

Mr. F. Gill, *Col. H. C. L. Holden, *Prof. G. Kapp, Mr. C. P. Sparks.

Members of Council.

Mr. W. Duddell	Mr. C. H. Wordingham
„ S. Evershed	„ A. A. C. Swinton
„ H. E. Harrison	* „ W. Rutherford
*Dr. E. Hopkinson	* „ S. L. Pearce
*Mr. J. W. Jacomb Hood	„ M. O'Gorman
„ Walter Judd	„ G. W. Partridge
* „ W. M. Mordey	* „ W. H. Patchell
„ J. E. Kingsbury	

Associate Members.

Mr. A. Campbell, *Mr. H. Human, Mr. J. H. Gray.

Hon. Auditors.

*Mr. H. Alabaster, Mr. Sidney Sharp.

Hon. Treasurer—Mr. Robert Hammond.

* Denotes new appointments.

INSTITUTION OF ELECTRICAL ENGINEERS (BIRMINGHAM SECTION).—The report of the Committee to the annual general meeting to be held on Wednesday next shows that the Committee for Session 1907-8 stands as follows:—*Chairman*, G. Kapp, M.Inst.C.E.; *Past Chairmen*, W. E. Sumpner, D.Sc., R. Threlfall, F.R.S., R. A. Chattock; *Vice Chairman*, R. K. Morcom; *Ordinary Members*, A. H. Bate, V. Bornand, A. R. Everest, A. L. Forster, W. E. Groves, C. W. Hill, Henry Lea, M.Inst.C.E., D. K. Morris, Ph.D., A. Pearson, M. Railing, A. M. Taylor, J. C. Vaudrey, M.Inst. C.E.; *Hon. Secretary*, H. B. Matthews.

INSTITUTION OF ELECTRICAL ENGINEERS (GLASGOW SECTION).—At the recent meeting of the Section the chairman, Mr. W. W. Lackie, stated that the Council had nominated office-bearers as follows:—Prof. Bailey, Edinburgh, chairman; Mr. E. George Tidd, vice-chairman; members of committee, Messrs. T. B. Murray, J. Lowson, F. A. Newington, J. S. Nicholson, C. Day, J. K. Stothert, William McWhirter, J. E. Sayers, W. B. Hird, and W. W. Lackie. The secretary remains to be appointed by the Council.

KING'S COLLEGE (UNIVERSITY OF LONDON).—The forty-seventh annual dinner will be held at the Hotel Cecil on Monday, May 27th. The Bishop of St. Albans will be in the chair.

ROYAL INSTITUTION.—On Friday last Mr. J. Swinburne, F.R.S., gave a lecture on the subject of "Incandescent Illuminants."

Electric Shock Fatalities.—On Saturday last an inquest was held at Ebbw Vale on the body of John George Rhead (28), who was killed by an electric shock at the Marine Colliery, Cwm, on the previous Thursday. Henry Prosser said deceased was a colliery electric engine driver, and on Thursday he saw him take hold of a lighting wire, and instantly fall. Witness rendered the necessary first aid, but death ensued, deceased not recovering consciousness. Witness, who was a journeyman, said he knew there was an uncovered live wire at this spot, because on the Friday previously the wire was broken by a passing horse, and witness had made the joint where the accident occurred. He did not report it to the management; although he knew nothing about electricity he had repaired the wire before. Deceased knew the wire had been broken at the spot of the accident, because he had switched the current off while he fastened the wire.

According to the report in the *South Wales Daily News*, in reply to the management, witness said he had no right to repair the wire, but the lights went out, and it was a matter of convenience to get the wire right.

Richard Price said he saw deceased repair the joint on the Friday. He had a pair of rubber gloves on at the time. It was through taking hold of this joint that deceased was killed. Edgar Watkins, the chief electrician, said deceased had no right to repair the wire; all breakages should have been reported to him. He reported on the condition of the cable and plant once a week.

The jury returned a verdict of "Accidental death," adding they were of the opinion sufficient care had not been taken by the management in seeing that the wires were properly protected, and they condemned the practice of allowing unauthorised persons to repair breakages, and recommended that the officials make more frequent reports on the condition of the cable.

On Monday, according to the *Yorkshire Herald*, a blacksmith employed at the Acklam Ironworks was carrying a number of long iron rods on his shoulders, and one of these, it is supposed, came in contact with a "live" overhead electric wire. He fell to the ground, and was picked up motionless and conveyed to the Infirmary, where it was found he was dead.

C. B.—Mr. Charles Bright, F.R.S.E., M.I.E.E., lectured on Tuesday at the Cavendish Laboratory, Cambridge University, the subject being "Submarine Telegraphy." To our unspeakable regret, we spoke last week of Mr. Charles Bright as Mr. C. Bright. There is another Mr. C. Bright, who is also Mr. Charles Bright (an American, but no relation to Mr. Charles Bright, the Englishman, and with whom Mr. Charles Bright, F.R.S.E., has no desire to be confused), and the omission of the letters F.R.S.E., &c., might give the impression to those who do not know any better that Mr. Charles Bright, F.R.S.E., was Mr. Charles Bright!

Conversazione of the Chartered Institute of Patent Agents.—At the Royal Institute of Painters in Water Colours, Piccadilly, on Wednesday, April 24th, a conversazione of the Chartered Institute of Patent Agents was held. This function is biennial, and on the present occasion was extremely well attended. Some 420 visitors were graciously received by the President (Mr. J. C. Fell), and Mrs. A. Burtwell, among these being Sir Wm. Ramsay, Prof. Armstrong, Prof. John Perry, Prof. Robinson, and Mr. Swinburne representing Science; Sir T. Barclay, Sir Joseph Lawrence, Mr. J. Cutler, K.C., Mr. T. Terrell, K.C., Mr. R. W. Wallace, K.C., Mr. A. J. Walter, K.C., and Mr. G. H. Radford, M.P., representing the Law: whilst Mr C. N. Dalton, C.B. (Comptroller-General of Patents), and Mr. H. Hatfield, I.S.O. (Deputy-Comptroller of Patents), amongst others represented the Patent Office. The main object of the Chartered Institute of Patent Agents is the regulation and advancement of the profession of Patent Agency. There are now 257 registered patent agents, and 161 Fellows of the Institute. Wednesday's proceedings were carried out in a manner which did the utmost credit to those concerned. During the evening well-received songs were rendered by Miss Carrie Herwin, Miss Kathleen Mayer, and Mr. Ernest Taylor. The band of H.M. Royal Artillery, by permission of the commanding officer and conducted by Mr. E. C. Stretton, R.A., played some delightful music at intervals.

Copper.—The directors of the Mountain Copper Co., in their report for last year, state that their sales of copper for delivery during the year were 2,854 tons, against 4,564 tons in the previous year. In accordance with the policy proposed by the board and adopted in 1904, the old smelting works at Keswick were closed in 1905, and a new establishment erected in the neighbourhood of San Francisco, in which not only the copper contained in the ore could be recovered, but also the sulphur contents utilised. The closing of the works had proved to have been not inopportune, as it has left for treatment a quantity of rich copper ore which would otherwise have been smelted and marketed during a period of comparatively low prices. Directly it was realised that the world's consumption was likely to keep the price of copper at or near the high price to which it has recently risen, the general manager intimated that he could, at a moderate outlay, start up and work, at any rate for a time, part of the old Keswick smelting plant, and as, by the company's successful appeal in the First Court, the Government injunction was lifted (pending further action by the Government), the board naturally decided to take advantage of the good prices to resume smelting at Keswick, and they are able to report that one of the old furnaces has lately been blown in, and that it is hoped the output of copper during the present year may be increased by about 2,000 tons.

Appointments Vacant.—Engineer to the Savoy Hotel Co. (£350 and commission on economies); switchboard attendant for Kendal (25s.); deputy electrical engineer for Salford (£250).

Electro-Enamel.—"Magnet" wants to know the name and address of the manufacturers of this enamel.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—At the Partick electricity works on Saturday last, 27th ult., a presentation was made to Mr. and Mrs. H. B. MAXWELL on the occasion of their leaving Partick to go to South Africa. Mrs. Maxwell was presented with a gold pendant set with pearls and chain, and Mr. Maxwell with a teak-wood camera in case suitably inscribed. The presentation was made by the chief clerk, Mr. Andrew Bennet.

Mr. A. KIRKHAM, of the Morecambe electricity staff, who has been appointed electrical engineer to the Burnley Co-operative Society, has been presented by the staff with a timepiece.

The Darlington T.C., on April 26th, decided to increase the salary of Mr. LUNN, electrical engineer, by £50 per annum, with a further increase of £50 on April 1st, 1908.

The Stoke-on-Trent T.C. has, by the casting vote of the Mayor, increased the salary of Mr. TIDDEMAN, electrical engineer, from £300 per annum to £350.

At noon on Saturday last the employés at the electricity works of the Halifax Corporation assembled in a room at the works to make a presentation to Mr. P. PRIESTLEY, deputy electrical engineer, who is leaving Halifax, after seven years, to become the chief engineer and tramway manager to the Mexbro' and Swinton Tramway Co. The presentation took the form of a roll-top desk. Alderman T. Hey, the chairman of the Halifax Electricity and Tramways Committee, made the presentation. He felt sure the Mexbro' and Swinton Co. would find in Mr. Priestley a most valuable official, and when he had worked the Mexbro' Company into a sound concern he would, perhaps, be able to give Halifax a few tips. Mr. Rogerson, chief electrical engineer, in moving a vote of thanks to Alderman Hey, remarked that the present to Mr. Priestley had been subscribed for by practically every member of the staff.

The Lighting Committee of Tunbridge Wells T.C. has recommended the Council to accept the resignation of Mr. H. L. P. BOOT, electrical engineer, and appoint him as consulting electrical engineer at a salary of £350 per annum. Mr. Boot is to take the sole responsibility for the general management of the undertaking, and to advise the Council on all capital outlay and extensions.

The Hampstead B.C. has appointed Mr. J. E. BARNES as junior assistant engineer at the electric lighting station, in place of Mr. S. D. Barnwell resigned.

On the occasion of his leaving the Clyde Valley Electrical Power Co. to take up the post of shift engineer in the combined lighting and tramway station of the Aberdeen Corporation, Mr. A. BLACK was, on the 28th ult., presented with a silver cigarette case by the electrical staff of the company's Yoker generating station.

Mr. W. H. ELLIS has been appointed assistant mains superintendent at the City of Chester electricity works.

Tramway Officials.—According to the Australian *Electrical Record*, Mr. W. T. GOODMAN has recently been selected from among 31 applicants for the post of engineer to the Adelaide Electric Tramway Trust. He is at present in charge of electrical works in Dunedin (N.Z.). The salary is £1,250 per annum. Mr. Goodman is a civil and electrical engineer, and was engaged on the Blackpool Electric Tramways, on the Liverpool Electric Railway, on the City and South London Electric Railway, and on the London, Brighton, and South Coast Railway. He spent considerable time in America, and at Hamburg and Berlin, gaining experience in electric tramways, and went to Australia to take the position of engineer to the Brush Electrical Engineering Company, and shortly afterwards was appointed by the New South Wales Government to the position of electrical and mechanical engineer in the tramway construction branch of the Public Works Department under Mr. Henry Deane. In Sydney, he designed a large portion of the work of the tramways, and he resigned that position to carry out electrical and mechanical work for Messrs. Noyes Bros. He was then entrusted with the designing and carrying out of the whole of the works of the Dunedin Electric Tramways. He has also acted as consulting engineer for the Christchurch City Council, and carried out the designing and installation of the city electric lighting plant in connection with the refuse destructor. He has been consulted by the New Zealand Government on several matters in connection with the electrification of lines of railway and the installation of electric tramways. He was offered the position of electrical engineer to the New South Wales Government, but he had to decline that because of his other engagement. He is a member of the Institution of Electrical Engineers, of London, and of the American Institute of Electrical Engineers.

The managers and staff of the Darlington tramways have presented a marble timepiece to Inspector J. MUSGRAVE on his marriage.

On Monday, April 22nd, Mr. C. BARBER, traffic manager of the Bournemouth Corporation tramways, was presented with a marble clock and ornaments, a silver tea service, and a framed photograph of the tramway employés, on the occasion of his marriage. The presentation was made by Alderman Lawson, the Chairman of the Tramways Committee.

The Tramways Committee of the Bury (Lancs.) T.C. has recommended that the salary of Mr. W. CLOUGH, tramways manager, be increased from £250 to £300 per annum, rising by £50 a year to a maximum of £400.

General.—Our readers will learn with regret that Mr. R. HUMPHRIES, who so recently went out to Malta as general manager and chief engineer of the electric tramways system there, is about to return to England under medical advice. He will on his arrival undergo an operation.

The chief Corporation officials at Birkenhead have presented a silver salver to Mr. WM. BATES, who has resigned the position of electrical engineer. Mr. Bates has accepted an appointment with Messrs. R. & J. H. Rea, of London and Liverpool.

Mr. A. C. KELLY, Assoc.M.Inst.C.E., who was for several years on the staff of the locomotive department of the Great Eastern Railway, has recently been appointed traction engineer to the British Westinghouse Electric and Manufacturing Co., Ltd., with headquarters at Manchester.

Mr. FRED S. HOLDER, who arrived from Australia some time ago, and has been with the British Westinghouse Co. since, has left for Rio Janeiro, where he will take up an important position in connection with the South American business of the company.

The staff of Messrs. Crompton & Co., Ltd., Arc Works, Chelmsford, have presented a gold demi-hunter watch to Mr. W. RICHARDSON, who is leaving the employ of the firm.

Mr. R. N. TWEEDY, A.M.I.E.E., has been appointed manager of the Dublin and South of Ireland branch of William Coates & Son, Ltd., 5, Leinster Street, Dublin, and Belfast, and sole agent for the Westinghouse Co. in Ireland. Messrs. Coates are engaged at present on the electrical installation at the Irish International Exhibition.

On Wednesday, April 24th, at the offices of the Great Northern and City Electric Railway, at Highbury Place, Mr. R. P. BROUSSON, the chief engineer and traffic manager, on the occasion of his marriage with Miss Goddard, of Sudbury, was presented with a pair of antique silver candelabra, on behalf of the principal members of the various departments of the railway. The presentation was made by Mr. Crewe, the chief traffic inspector. The wedding took place at St. John's Church, Wembley, on Saturday, April 27th. Deputations from the railway staff, and the East London Engineers, of which corps Mr. Brousson is a captain, were also present.

Obituary.—The death occurred suddenly of pneumonia at Lyne Grove, Virginia Water, on Tuesday, of Mr. THEODORE JULIUS HARE, chairman of the Baker Street and Waterloo Railway. He was 68 years of age.

We regret to learn from the copy of our exchange, *Indian Engineering*, which is to hand this week, that Mr. PAT DOYLE, proprietor and editor of that paper for 20 years, has passed away. It seems that he left Calcutta, in indifferent health, on March 16th, for Bombay, *en route* for England, but his death occurred at Bombay on March 27th. He was born in 1849.

The *Southport Visitor* records the death of Mr. GEORGE HUDSON RAWSTHORN, who was formerly superintendent of the Telegraphs Department of the Manchester Post Office.

Brigadier-General EUGENE GRIFFIN, first vice-president and general sales manager of the General Electric Co., died very suddenly of apoplexy at Schenectady, N.Y., on the evening of April 10th. With his wife and daughter, he had gone to Schenectady to witness an amateur play given by a local club, of which his son, Hancock Griffin, was a leading member. Following the performance, while at an informal supper with a few friends, the General collapsed, expiring about an hour later. Trained as a military engineer at West Point, he entered the business world as second vice-president of the Thomson-Houston Co. Upon the consolidation of that company with the Edison Electric Co. (forming the General Electric Co.), General Eugene Griffin became the first vice-president of the General Electric Co., holding this office until his death. He was born in 1855, at Ellsworth, Maine. Upon leaving the Army in 1889, Captain Griffin entered the service of the Thomson-Houston Electric Co. as second vice-President. This position he held until 1891, when the Thomson-Houston Co. was consolidated with the General Electric Co. He was then elected to the office of first vice-President of the General Electric Co. In 1893 he was elected to the position of President of the Thomson-Houston International Electric Co. He was also a director of the British Thomson-Houston Co., Ltd., and the Compagnie Française pour l'exploitation des Procédés Thomson-Houston, Paris. At the outbreak of the Spanish-American War, Captain Griffin offered his services to the United States Government. On word from Washington he organised the first regiment U.S. Volunteer Engineers, of which he became Colonel. This regiment was mustered into service in the spring of 1898. The following year, in January, he was promoted to the rank of Brigadier-General. This title he held at the close of the war.

NEW COMPANIES REGISTERED.

J. Halden & Co., Ltd. (92,899).—This company was registered on April 13th, with a capital of £40,000 in £1 shares, to acquire the business carried on in Manchester, London, Newcastle-on-Tyne and elsewhere, by J. Halden, G. F. Pringle, and J. R. Ball, as J. Halden & Co., and to carry on the business of manufacturers and sellers of drawing materials and papers, mathematical instruments and specialities, surgical instruments, cutlery, electric arc lamps, electric photographic copying apparatus, engineers' photo and copying process materials, photographic materials, cinematograph instruments, lead pencils, pens, tools, clocks and watches, surveying and optical instruments, gramaphones, phonographs and records, telescopes, ivory and vulcanite goods, &c. The first subscribers (each with one share) are: J. Halden, Woodlands, Ellesmere Park, Eccles, near Manchester, drawing material dealer; G. F.

Pringle, 59, Percy Bank, Tynemouth, Northumberland, drawing material dealer; J. R. Ball, 41, Connaught Road, Harleeden, N.W., drawing material dealer; W. Monkhouse, 21, Southdean Gardens, Wimbledon Park Road, S.W., traveller; W. V. Brown, 13, Ash Grove, Headingley, Leeds, traveller; H. R. Watts, Arrundale, Arrundale Avenue, Brooklands, Cheshire, optician; E. W. M. Taylor, 47, Roxburgh Terrace, Whitley Bay, R.S.O., Northumberland, traveller; and W. A. Halden, Woodlands, Ellesmere Park, Eccles, near Manchester, photographic chemist. No initial public issue. The number of directors is not to be less than three or more than ten; the first are J. Halden, G. F. Pringle and J. R. Ball (permanent governing directors), W. A. Halden, W. Monkhouse, W. V. Brown, H. R. Watts, R. F. Moir, L. Wordsworth and E. W. M. Taylor. Qualification of permanent governing directors, £1,000; of other directors, 50 shares; remuneration of governing directors, £400 each per annum. Registered office, Altrincham Street, Manchester.

Simms Magneto Co., Ltd. (92,990).—This company was registered on April 19th, with a capital of £100 in £1 shares, to carry on the business of manufacturers and proprietors of, and dealers in, magnetos, magneto parts and accessories, motors, motor and other carriages, cycles and other vehicles, jobmasters, carriers, electricians, suppliers of electricity, &c. The first subscribers (each with one share) are:—R. Bugden, 18, Chailey Street, Clapton, N.E., clerk; P. Robe, Ifield Lodge, Talbot Road, West Ealing, W., clerk; W. Price, 79, Dongola Road, West Green, N., clerk; H. Doe, 50, Broughton Street, Lavender Hill, S.W., clerk; W. H. Weekes, 18, Birkbeck Road, Acton, clerk; H. H. Laws, 5, Esmond Road, Kilburn, N.W., clerk; and J. T. Higginbottom, 87, Stanhope Gardens, Harringay, N., clerk. No initial public issue. The number of directors is not to be less than three nor more than five; the subscribers are to appoint the first. Remuneration as fixed by the company.

Dumbarton Burgh and County Tramways Co., Ltd. (6,482).—This company was registered in Edinburgh on April 13th, with a capital of £130,000 in £1 shares, to construct, purchase or otherwise acquire, manage and work any light railways, electric or other tramways and electric lighting or power undertakings, and in the event of the Act of Parliament being confirmed, to take over the business of the Dumbarton Burgh and County Tramways Co., Ltd. The first subscribers (each with one share) are:—K. A. S. Moncrieff, Salisbury House, London Wall, E.C., engineer; C. Tufnell, Salisbury House, London Wall, E.C., underwriter; E. Reeves, Salisbury House, London Wall, E.C., secretary; F. R. Reeves, Salisbury House, London Wall, E.C., engineer; W. Abbott, Salisbury House, London Wall, E.C., clerk; K. Sanderson, 15, York Place, Edinburgh, W.S.; and W. T. Purves, 59, York Place, Edinburgh, civil engineer. The number of directors is not to be less than three nor more than six; the first are to be afterwards appointed; qualification, 100 shares; remuneration as fixed by the company. Registered office, 15, York Place, Edinburgh.

Shields Construction Syndicate, Ltd. (93,132).—This company was registered on April 26th, with a capital of £5,000 in 4,500 ordinary shares of £1 each and 20,000 deferred shares of 6d. each, to undertake the construction and equipment of any light railway, tube railway or tramway, to acquire any Order or Act of Parliament relating to the same, to adopt an agreement with E. Anderson, to enter into any other agreements for the acquisition of concessions or licences for the establishment of railways or tramways, the installation of electric lighting or the accumulation, distribution and supply of motive power, and to carry on business as electricians, engineers, contractors, carriers, omnibus and van proprietors, manufacturers of and dealers in engines, accumulators, dynamos, motors, rolling stock and machinery, suppliers of electricity, &c. The first subscribers (each with one share) are:—E. Anderson, 62, London Wall, E.C., merchant; H. Bacon, 62, London Wall, E.C., secretary; H. J. Silverlock, Stock Exchange, E.C., gentleman; S. Fawns, 26, Sussex Mansions, South Kensington, S.W., mining engineer; J. Conchie, 13a, Porchester Terrace, W., merchant; D. J. Paterson, 53, New Broad Street, E.C., secretary; and J. W. Pollock, 144, Camberwell Grove, S.E., accountant. No initial public issue. The number of directors is not to be less than two or more than seven; the first are E. Anderson, H. J. Silverlock and Lieut.-Colonel Hon. F. L. L. Colborne; remuneration, £50 each per annum (chairman £100) and 5 per cent. of the net profits available for appropriation, divisible. Registered office, 62, London Wall, E.C.

W. R. Sykes Interlocking Signal Co., Ltd. (93,078).—This company was registered on April 24th, with a capital of £50,000 in 10s. shares, to adopt an agreement between a company of the same name (incorporated in 1899), and W. Ives and W. R. Sykes, jun., the liquidators thereof, of the first part, J. E. Nicholas and A. H. Johnson of the second part, and the company of the third part, for the acquisition of the business carried on at Clapham by the said old company, and to carry on the business of signal manufacturers, telephone, telegraph and electrical and mechanical power, owners and workers, constructors of cables, mains, lines, stations, exchanges, reservoirs, accumulators, lamps, meters and engines, and any other business directly or indirectly connected with railway or other signals, &c. The first subscribers (each with one share) are:—W. R. Sykes, sen., Cedar Lea, Bickley, engineer; G. H. Sykes, 36, Voltaire Road, Clapham, S.W., engineer; E. W. Leest, 29, Nightingale Lane, Balham, S.W., clerk; W. R. Sykes, Wyndcott, Birchwood Park Avenue, Swanley, engineer; E. Anson, 7, Rodway Road, Roehampton, S.W., civil engineer; W. Ives, 46, Narbonne Avenue, Clapham Common, secretary and accountant; and P. G. Busby, 62, Army Street, Clapham, S.W., clerk. No initial public issue. The number of directors is not to be less than two, or more than seven; the subscribers are to appoint the first; qualification, 250 shares; remuneration, £200 each per annum (£50 extra for the chairman). Registered office, 26, Voltaire Road, Clapham, S.W.

Arthur Harburn, Ltd. (93,116).—This company was registered on April 26th, with a capital of £500 in £1 shares, to carry on the business of motor and general engineers, repairers of, and dealers in, motor-cars, motor and other cycles, carriages and machines, electricians, engineers, suppliers of electricity, manufacturers of dynamos, lamps, wire, cables, insulating materials, accumulators, telephones and other electrical apparatus and materials, &c. The first subscribers (each with one share) are:—J. Townend, Elmside, Bishop Auckland, dental surgeon; H. M. Wood, Park View, Bishop Auckland, grocer; G. Veitch, Clyde House, Bishop Auckland, draper; T. H. Taylor, Kensington, Bishop Auckland, accountant; E. E. Harwood, 72, Newgate Street, Bishop Auckland, clerk; A. J. Law, 53, Newgate Street, Bishop Auckland, clerk; and N. Thompson, 1, Albert Hill Terrace, Bishop Auckland, clerk. No initial public issue. The number of directors is not to be less than two or more than five; the first are J. Townend, G. Veitch and H. Wood Registered office, 70, Newgate Street, Bishop Auckland.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

St. James' Illuminating Co., Ltd. (63,773).—This company's annual return was filed on March 8th, when 97 shares had been taken up out of a nominal capital of £2,000 in £5 shares. £485 has been received. Mortgages and charges: Nil.

Electric Canal Haulage Co., Ltd. (60,462).—This company's annual return was filed on February 25th, when seven shares had been taken up out of a nominal capital of £3,000 in £1 shares; £7 has been received. Mortgages and charges: Nil.

Cambridge Electric Tramways Syndicate, Ltd. (79,744).—This company's annual return was filed on March 5th, when 107 shares had been taken up out of a nominal capital of £5,000 in £10 shares. £9 0s. 4½d. per share has been called up on 90, £10 per share on 10 and nil on seven, and £911 12s. 1d. has been received. Mortgages and charges: Nil.

Chiswick Electricity Supply Corporation, Ltd. (38,854).—Issue on March 20th of £5,700 4½ per cent. debentures, part of series created by resolutions of November 2nd, 1900, and March 8th, 1901, to secure £50,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. Previously issued of same series: £44,300.

Durham Collieries Electric Power Co., Ltd. (83,421).—A memorandum of satisfaction in full of a charge dated February 2nd, 1907, securing £18,000, has been filed.

Kirlew Bros., Ltd. (electrical engineers, London), (49,449).—A debenture created by resolutions of June 6th, 1902, and April 6th, 1903, and dated March 25th, 1907, to secure £1,000, charged on the company's property, present and future, including uncalled capital, has been registered. Holder: Mrs. L. J. Kirlew, 33, Hardwicke Road, Palmer's Green, N.

Eastern Telegraph Co., Ltd. (6,338c).—This company's annual return was filed on February 13th, when £5,999,890 had been taken up and paid in full out of a nominal capital of £6,000,000 in £4,000,000 ordinary stock and £2,000,000 preference stock. Mortgages and charges: £1,907,704.

Direct United States Cable Co., Ltd. (11,597).—This company's annual return was filed on February 19th, when 60,710 shares had been taken up out of a nominal capital of £1,300,0 0 in 65,000 shares of £20 each. £1,214,200 is considered as paid. Mortgages and charges: Nil.

Cowper-Coles Galvanising Syndicate, Ltd. (41,223).—This company's annual return, made up to December 31st, was filed on March 13th. The entire capital of £2,000 in 500 "A" and 1,500 "B" shares of £1 each has been taken up. £1 per share has been called up on 500 "A" and 500 "B," and £1,000 has been received. £1,000 is considered as paid on 1,000 "B." Mortgages and charges: £1,100.

Central Electric Supply Co., Ltd. (53,080).—This company's annual return was filed on February 14th, when the entire capital of £100,000 in £5 shares had been taken up and paid for in full. Mortgages and charges: £336,876 4 per cent. guaranteed debenture stock.

C. H. Mason, Wilson & Co., Ltd. (91,475).—This company's annual return was filed on March 16th, when 565 shares had been taken up out of a nominal capital of £1,000 in £1 shares. £1 per share has been called up on five, and £5 has been received. £560 is considered as paid on the remainder. Mortgages and charges: £270.

British Electric Equipment Co., Ltd. (82,542).—Issue on March 20th of £2,000 5 per cent mortgage debentures, part of series created same date to secure £20,000, charged on the company's undertaking and property, present and future, including uncalled capital. No trustees. No previous issue of same series.

African Trans-Continental Telegraph Co., Ltd. (37,855).—This company's annual return was filed on March 22nd, when 226,850 shares had been taken up out of a nominal capital of £300,000 in £1 shares. £1 per share has been called up, and £225,855 has been received, leaving £995 in arrears. A further £10 has been paid on 20 forfeited shares. Mortgages and charges: Nil.

Yarmouth (I.W.) Electricity Supply Co., Ltd. (56,884).—This company's annual return was filed on March 18th, when 327 shares had been taken up out of a nominal capital of £5,000 in £5 shares. £1 per share has been called up, and £1,635 has been received. Mortgages and charges: Nil.

Bishop's Stortford and Stansted Electric Lighting Co., Ltd. (81,397).—This company's annual return was filed on February 8th, when the entire capital of £1,000 in £1 shares had been taken up and paid for in full. Mortgages and charges: Nil.

Cambridge Electric Supply Co., Ltd. (36 457).—This company's annual return was filed on March 15th, when 9,423 shares had been taken up out of a nominal capital of £100,000 in £10 shares. £1 per share has been called up and £84,807 has been received. Mortgages and charges: £30,000 first debentures and one debenture with Capital and Counties Bank, Ltd., to cover £10,000.

Sanitas Electrical Co., Ltd. (72,615).—This company's annual return was filed on March 12th, when 4,250 shares had been taken up out of a nominal capital of £5,000 in £1 shares. £2,250 has been received, leaving £2,000 in arrears. Mortgages and charges: Nil.

Melton Mowbray Electric Light Co., Ltd. (53,018).—This company's annual return was filed on April 3rd, when 4,000 shares had been taken up and paid for in full out of a nominal capital of £25,000 in £5 shares. Mortgages and charges: £20,000.

Issue on March 20th of £5,000 5 per cent. debentures, part of series created March 6th, 1901, to secure £20,000. Property charged (by trust deed): Certain freehold land in Regent's Street, Melton Mowbray. (By debentures): The company's lands, buildings, works, plant, effects, undertaking and other assets, including uncalled capital. Trustees: W. B. Hopkins, Clun House, Surrey Street, Strand, W.C., and F. E. Gripper, Broad Sanctuary Chambers, S.W. Previously issued of same series: £15,000.

Highgate Hill Tramways, Ltd. (48,333).—A deed dated February 23rd, 1907 (supplemental to a mortgage dated January 23rd, 1907, securing £1,700 and further advances up to £4,000, plus the expenses of this supplemental deed), has been registered. The deed provides for the inclusion of certain moneys in the said mortgage. Property charged by mortgage: The company's interest in the Highgate Hill tramways, with the tramway lines and right to work the same and use the rolling stock. Trustee: J. M. Garland, Sutton Coldfield.

Bartitsu Light Cure Institute, Ltd. (87,817).—Issue on March 7th of £3,000 debentures, part of a series created February 28th, 1907, to secure £3,000. Property charged: The company's undertaking and property, present and future, including uncalled and unpaid capital. No trustees. No previous issue of same series.

Peterborough Electric Traction Co., Ltd. (74,562).—An acknowledgment of indebtedness under seal, dated March 12th, 1907 (supplemental to a trust deed dated June 26th, 1908), securing a further £1,000 debenture stock (making, with £20,000 debenture stock already registered, a total of £21,000), charged on the company's property, present and future, has been registered. Trustees: Electric and General Investment Trust Co., Ltd., 1 and 2, Great Winchester Street, E.C.

Municipal Electric Light and Power Corporation, Ltd. (29,091).—This company's annual return, made up to December 30th, was filed on February 18th. 37 ordinary and 80 founders' shares have been taken up out of a nominal capital of £25,000 in 2,490 ordinary shares of £10 each and 100 founders' shares of £1 each. £10 per share has been called up on the ordinary and £1 per share on the founders', and £400 has been received. Mortgages and charges: Nil.

Sherardising Syndicate, Ltd. (London), (73,024).—A memorandum of satisfaction in full of debentures dated February 27th and June 27th, securing £1,100, has been filed.

Electric Wiring and Fittings Co., Ltd. (29,676).—This company's annual return was filed on February 27th, when 1,382 shares had been taken up out of a nominal capital of £5,000 in £1 shares. £1 per share has been called up, and £1,375 has been received, leaving £7 in arrears. Mortgages and charges: Nil.

Volenite, Ltd. (57,337).—This company's annual return, made up to December 31st, was filed on February 15th. 79,939 shares have been taken up out of a nominal capital of £80,000 in £1 shares. £1 per share has been called up on 34,939, and £34,939 has been received. 4,500 shares are considered as fully paid. Mortgages and charges: £34,283 12s. 7d.

H. J. Cash & Co., Ltd.—This company's annual return was filed on March 8th, when 6,000 shares had been taken up out of a nominal capital of £10,000 in £1 shares. 12s. 6d. per share has been called up, and £3,750 has been received. Mortgages and charges: Nil.

London Electric Wire Co., Ltd. (36,544).—This company's annual return was filed on March 5th, when 15,807 ordinary, and 5,956 preference shares had been taken up out of a nominal capital of £160,000 in £5 shares (10,000 preference). £5 per share has been called up on 8,087 ordinary and 5,956 preference, resulting in the receipt of £70,215. £38,600 is considered as paid on 7,720 ordinary shares. Mortgages and charges: Nil.

St. James' and Pall Mall Electric Light Co., Ltd. (26,015).—This company's annual return was filed on March 6th, when the entire capital of £300,000 in £5 shares (20,000 preference) had been taken up. £5 per share has been called up on 39,650 ordinary and 20,000 preference, resulting in the receipt of £298,250. £1,750 is considered as paid on 350 ordinary. Mortgages and charges: £150,000 3½ per cent. debenture stock and £168,438 4 per cent. guaranteed debenture stock of the Central Electric Supply Co., Ltd., being half the loan capital.

Chatham, Rochester and District Electric Lighting Co., Ltd. (24,773).—This company's annual return, made up to December 31st, was filed on February 8th. The entire capital of £50,000 in £5 shares has been taken up. £5 per share has been called up on 6,224, resulting in the receipt of £31,112. £8 remains in arrears. £18,880 is considered as paid on 3,776 shares. Mortgages and charges: Nil.

Beck & Moss, Ltd. (69,298).—This company's annual return was filed on March 5th, when the entire capital of £2,500 in £1 shares had been taken up; £525 has been received, and £1,975 is considered as paid. Mortgages and charges: £800.

W. S. Laycock, Ltd. (68,203).—This company's annual return was filed on February 27th, when the entire capital of £150,000, in 100,000 ordinary and £50,000 preference shares of £1 each had been taken up; £1 per share has been called up on seven ordinary and 50,000 preference, resulting in the receipt of £50,007; £99,993 is considered as paid on 99,993 ordinary. Mortgages and charges: Nil.

Northwich Electric Supply Co., Ltd. (46,958).—This company's annual return was filed on March 21st, when 3,629 shares had been taken up out of a nominal capital of £25,000 in £5 shares; £5 per share has been called up, resulting in the receipt of £18,145. Mortgages and charges: £11,000.

Lancashire Dynamo and Motor Co., Ltd. (61,447).—A trust deed dated March 4th, 1907, to secure £75,000 debentures, created by resolution of even date, has been registered. Property charged: Two plots of land in Trafford Park, Stretford, with buildings, plant, &c., thereon, and the company's undertaking and general assets, present and future, except uncalled capital. Trustees: E. F. Sheppard, 55, King Street, Manchester, and A. Tongue, 86, King Street, Manchester.

Britannia Electric Lamp Works (1905), Ltd. (86,967).—Particulars of £200 debentures, created by resolution of March 11th, 1907, have been filed pursuant to Sec. 14 (4) of the Companies' Act, 1900. Property charged: The company's undertaking and property, present and future, except uncalled and unissued capital. No trustees.

South African Lighting Association, Ltd. (27,609).—Re-issue on March 21st of £250 5 per cent. debentures, part of series created May 17th, 1903, to secure £10,000, charged on the company's undertaking and property, subject to a first charge for £20,000. No trustees. Previously issued of same series: £10,000.

Bath Electric Tramways, Ltd. (74,278).—Issue on March 26th of a £100 5 per cent. second mortgage debenture, part of series created March 6th, 1906, to secure £16,000, charged on the company's undertaking and property, present and future, subject to £142,000 4½ per cent. first mortgage debenture stock. No trustees. Previously issued of same series: £15,900. £8,000 5 per cent. "A" mortgage debentures, created March 26th, 1907, charged on the same property, subject to first mortgage debenture stock and second mortgage debentures, have also been registered. No trustees.

CITY NOTES.

Dudley, Stourbridge and District Electric Traction Co., Ltd.

THE twenty-fifth ordinary general meeting of this company was held on Thursday, April 25th, at Donington House, Mr. A. C. Miles presiding.

The CHAIRMAN, in moving the adoption of the report (see ELECTRICAL REVIEW, April 26th, page 692), said the directors had great pleasure in presenting the very satisfactory statement of accounts. The total receipts amounted to £46,282, which was £380 less than in the previous year. That decrease had been caused by a diminution of trade in the district, and a falling off of traffic in the Kinver district. The fares on some of the sections had been reduced, but the concession in that direction had, he thought, reached the limit. The expenses, after charging all cost of maintenance, cost of repairs and running, in addition to interest on the debentures and £500 to depreciation, showed a decrease of over £2,000. They must not, however, lose sight of the fact that in 1905 extensive renewals were made with the permanent way and rolling stock, which, of course, were not necessary in the current year. The office and general expenses had been reduced by £300. The net result of the year's working was that the directors were able to declare a 5 per cent. dividend, and the transference of £1,500 to the reserve and depreciation account, while the amount carried forward was double. The Birmingham and Midland Tramways Co. had extended, for 12 months from December 31st last, the date of the first payment of £3,000 on the Kinver Light Railway, and had also postponed the payment of the interest at the rate of 4 per cent. on the balance of the outstanding purchase money. That arrangement had been made in view of the proposed application of the purchase money to be received from the Dudley Corporation for the liquidation of the debt of £9,000 on account of the purchase of the Kinver Light Railway due to the Birmingham and Midland Co. during the present year. Further expenditure had been made on the Kinver Light Railway, so as to afford better accommodation for the increased traffic. Arrangements had been made with the other companies of the joint committee for the construction of a workshop and car-sheds at Tividale, just outside Dudley. The expenditure on capital account had been increased by just under £2,700, which had been principally in respect of improving the Kinver Light Railway. Investments remained at the same figure. It was expected that the appeal to the House of Lords in respect of the Dudley Light Railway would come on in the autumn. The amount to be paid on account of the trams by the Dudley Corporation to the company was £32,957, but should the appeal be successful they would get £32,576 on account of the light railway.

Mr. S. R. BLUNDSTONE seconded the motion, and the report was adopted without discussion.

Craigpark Electric Cable Co., Ltd.

THE directors' report for the year ending March 31st, 1907, records a net profit of £6,443, which, with the balance of £911 brought forward, makes £7,354. The directors recommend the following appropriations, viz.:—Preliminary expenses, amount written off, £700; depreciation written off buildings and machinery, £1,000; dividend (already paid) on 37,500 6 per cent. preference shares, for half-year ending September 30th, 1906, £1,125; ditto for half-year ending March 31st, 1907, £1,125; dividend on 37,500 ordinary shares, at 6 per cent. for the 12 months ending March 31st, 1907, £2,250; balance carried forward (subject to payment of directors' fees for the past year), £1,154. The cable department of the company's business shows a satisfactory increase, and although prices of the raw materials continue high, the directors, in view of an increasing volume of trade, look forward with confidence to the future. The golf ball department continues to be fully employed, and the directors anticipate an increased revenue from this source during the current year. The stocks have been carefully gone over and certified by the managing director.

Calcutta Electric Supply Corporation, Ltd.

THE directors' report for 1906 states that the progress of the company continues satisfactory. The accounts have been prepared in the form now required by the Government of India. This differs somewhat from the form previously adopted, and consequently the figures for last year are not readily comparable with those of former years. 4,578,380 units of electrical energy were sold during the year, an increase of 29 per cent. over 1905, when 3,548,229 units were sold, an increase of 28½ per cent. over the then preceding year. The gross revenue (£89,242) is nearly 23 per cent. higher than in the previous year, compared with an increase of 21¼ per cent. in 1905 over the receipts in 1904. The rate of progress has therefore been well maintained, notwithstanding a reduction of price for current. The working costs (£39,065) show, however, an increase of 33 per cent. compared with a increase of 23 per cent. last year. The capital expenditure at December 31st last amounted to £544,353—an increase of £46,075 during the year, necessitated by the continued expansion of the company's business. The principal items of expenditure are £5,661 on buildings, £19,480 on mains extensions, £12,480 on machinery, and £7,255 on meters. The following figures show the comparative results for the past four years, the net revenue being adjusted to the new form of accounts:—

Year.	Houses.	Equivalent connections in 8-c.p. lamps.	Units sold.	Gross revenue.	Net revenue.
1903	1,379	121,878	2,044,681	£47,139	£27,513
1904	1,814	163,853	2,760,457	£60,243	£36,406
1905	2,451	215,018	3,548,229	£72,591	£43,242
1906	3,060	262,893	4,578,380	£89,242	£50,176

Exchange is calculated at 1s. 4d. per rupee.

The presence of the item entitled "reserve fund account £84,592 10s." in last year's balance-sheet has given rise to some misunderstanding, the impression conveyed being that this account represents surplus profits set apart from past earnings to form a reserve fund, whereas it is made up of the premiums subscribed by the members of the several issues of shares made by the company from time to time, and might properly be described as "capital" subscribed without participation in the dividends. The directors have shown this item in the accounts herewith under the heading "share premiums." Exceptional difficulties have again been experienced with the feeders, and it is evident that a considerable proportion of the underground cables will have to be relaid. The whole of the repairs and renewals during last year (£8,882) have in accordance with the Government form of accounts, been charged against revenue instead of coming out of the renewals fund as in former years. The balance of the depreciation and renewals account at December 31st, 1906, amounted to £33,247, and the directors propose to further strengthen this provision by adding to the account out of the profits the sum of £12,000. The net profits for

the year amount to £50,177, to which has to be added the balance brought forward from last year, £4,358, and after deducting the interim dividend paid in November, 1906, and other items set out in the net revenue account, there remains an available balance of £39,486. The directors recommend, as stated above, that a sum of £12,000 be placed out of profits to the credit of the "depreciation and renewals account," and that a final dividend, at the rate of 10½ per cent. for the half year, be declared and paid on the paid-up share capital, making with the interim dividend 8½ per cent. for the year, the balance £5,206 being carried forward. The new stations at Howrah and Ultadangha have been completed and are now supplying electricity. The buildings and machinery of the company have been maintained in good and efficient repair during the year. It is proposed, when relaying the feeders above referred to, to increase the sectional area of some of the cables to meet the increased demand for current.

Auckland Electric Tramways Co., Ltd.

THE directors' report states that the total revenue for the year ended December 31st, 1906, amounted to £132,365, as compared with £122,995 for the previous year. The traffic receipts, which amounted to £130,337, show an increase of £8,458. After deducting all expenses chargeable to revenue, including £14,255 for interest on debenture stock, and providing for the rental and percentage of profits payable to the Auckland City Council amounting to £3,246, and after setting aside £10,000 to meet depreciation, there remains a surplus of £33,583, making with the £3,018 brought forward an available balance of £36,602, which the directors recommend should be applied as follows:—To reserve fund for general purposes, £12,500; to dividend at the rate of 7 per cent. per annum, £21,000; balance carried forward, £3,102. The directors propose that the account hitherto styled reserve and depreciation account shall in future be entitled depreciation account, and that the account shall be used exclusively for the purpose of providing for renewals and depreciation.

An arrangement has been made with the Auckland City Council whereby the watering of the streets on which tramways are laid in the city and in certain of the suburban districts will be undertaken by the company. Steps are being taken to obtain the most efficient water sprinklers for the purpose, and it is hoped that they will be available in Auckland in time for the next summer season. Differences having arisen between the Auckland City Council and the company with regard to the system formerly adopted to arrive at the profits earned within the city, upon which the Auckland City Council is entitled to a percentage, a new method has been suggested by the company, which it is believed will meet the City Council's views. To meet increasing traffics five additional cars have been added during the year; these will during the present year be increased by a further 12 cars, making the total rolling stock 72. The board have decided to take in hand the construction of the extension of about 3 miles in the Mount Eden Road district, referred to in the last report, immediately the necessary powers are obtained.

To cope with the demand to be created by the above extensions and to meet the increased traffic, further plant capable of an output of 600 KW. will be installed during the year. Mr. P. M. Hansen having resigned his position as managing director, the board have appointed Mr. J. J. Walklate, of the Potteries Electric Traction Co., general manager and engineer, and he will take up his duties in Auckland about the middle of May, Mr. Hansen acting as managing director until his arrival. Consequent upon Mr. Hansen's resignation he retires by rotation from his directorship of the company. The board propose that the vacancy caused by his retirement shall not be filled up, and that for the present the board shall consist of three members. The board have appointed Mr. Hansen, local director of the company in Auckland, and they wish to express their appreciation of the zeal and loyalty with which he has administered the affairs of the company in New Zealand since its inception.

	Year ended Dec. 31, 1905.	Year ended Dec. 31, 1906.
Miles open—Route miles	18·64	19·2
Single line	6·44	6·99
Double line	12·20	12·21
Number of passengers carried	19,789,045	21,104,651
Average receipts per passenger	1·46d.	1·48d.
Average expenditure per passenger	0·86d.	0·81d.
Proportion of expenses to receipts	58 %	55 %
Number of cars working	55	60

Indo-European Telegraph Co., Ltd.

AT the meeting held on Monday at 18, Old Broad Street, E.C., Mr. J. HERBERT TRITTON, in moving the adoption of the report (see ELECTRICAL REVIEW, April 19th, p. 652) and the declaration of dividend and bonus, first referred to the death of Mr. W. S. Andrews. He then stated that the electrical condition of the company's lines during the year had continued to be satisfactory. The daily traffic carried during the year was the largest during the company's history. This record traffic had been carried with an improvement both as to accuracy and speed over last year, and without any addition to the number of wires at the company's disposal. The reduction of rates for Turkish traffic by this company's route, consequent upon the arrangements to which he referred at the last general meeting, had enabled them to attract a satisfactory traffic. This had involved some re-arrangement of their Odessa station, attended with a certain amount of additional expense, but it would be to their advantage. The increase in volume of all classes of traffic taken together, had, however, not been sufficient to compensate for the loss of revenue resulting from the large reductions of tariff that had been in full operation during the year. The traffic returns for the first quarter of 1907 were, however, favourable, and if the improvement were maintained, they hoped to show better results for the current year. Taking the years 1904, 1905 and 1906, earnings on message account were respectively £138,284, £129,743 and £124,477, showing a reduction in 1906 of £5,266, as compared with 1905, and of £13,807 as compared with 1904—a serious falling off. The revenue account showed a decrease in receipts of £5,151, and an increase in expenses of £2,851, which was attributable partly to an increase in salaries and wages, and partly to maintenance charges, which were a fluctuating quantity, and did not call for close analysis. The directors had considered this a suitable time to bring into profit and loss the sum of £3,838, which was kept in last year's accounts as an open balance. The reduction in revenue was, unfortunately, accompanied by further depreciation in the value of the company's investments, a depreciation which merely reflected the condition of the Money Market, and for which the directors were in no way responsible, with the result that funds which would otherwise have been available for the retirement fund and for equalisation of dividends fund, had had to be utilised in writing off a depreciation in securities of £16,240 which had accrued during the year. The directors proposed the usual dividend of £14,875 and bonus £17,000, which left £8,975 to carry forward to the credit of 1907, as against £16,698 for the previous year. In considering the question of a special distribution out of interest on unappropriated investments, a sharp line should be drawn between this and the dividend and bonus derived from revenue. The shareholders had, after many years of economy and self-denial, accumulated available liquid assets, which stood in the balance-sheet at over £500,000. This company had no risks or liabilities against which to create a larger reserve fund, the only provision necessary to be made in the event of liquidation of the company being to the extent of the issued capital of £425,000. From this point of view, therefore, any further considerable additions to the reserve and other funds of the company would be simply to provide a premium over the par value of the shares on the final liquidation of the company, a provision which was obviously not within the duties of the directors. It might well be that increasing traffics might eventually necessitate a corresponding increase of carrying capacity, and that suitable opportunities might even present themselves for the extension of the system of operations of the company, but these possibilities hardly seem to justify further large accumulation of funds. The directors, therefore, recommended the distribution of interest accrued on the investments, which were termed in the balance-sheet "unappropriated," amounting to 15s. per share, as on previous occasions.

Sir FRANCIS MOWATT seconded the motion, and it was carried unanimously.

The retiring directors were re-elected, and the auditors were also re-elected, their fee being increased from 100 guineas, which it had been for the last 25 years, to 150 guineas.

Veritys, Ltd.—The report of this company for the year ended Jan. 31st, 1907, which was adopted at the annual meeting held on Tuesday, shows a prosperous state of affairs, the profits having again largely increased over those of the previous year, which in turn showed an advance on those of the year before. After paying the dividends on the preference shares, the cautious policy of only declaring 5 per cent. on the ordinary shares has been again adopted, and a sum of £8,250 been put to depreciation and reserves accounts, a balance of nearly £1,000 being carried forward. We gather from the report that in spite of severe competition from both home and foreign manufacturers, this old-established company is more than holding its own.

Stock Exchange Notices.—The Committee have appointed Special Settling Days as under:—

Friday, May 3rd.—British Columbia Electric Railway Co., Ltd.—Scrip (fully and partly paid) for £300,000 4½ per cent. perpetual consolidated debenture stock.

Tuesday, May 14th.—Straits Settlements (Bertram) Rubber Co., Ltd.—20,000 vendors' shares of £1 each, fully paid, Nos. 1 to 20,000.

And ordered the undermentioned to be quoted in the Official List:—

Anglo-Argentine Tramways Co., Ltd.—Further issue of 50,000 ordinary shares of £5 each, fully paid, Nos. 510,008 to 560,007.

British Columbia Electric Railway Co., Ltd.—Scrip (partly paid) for 300,000 4½ per cent. perpetual consolidated debenture stock.

Reading Electric Supply Co., Ltd.—The report for 1906 states that expenditure on capital account amounted on December 31st, 1906, to £159,109. The total revenue for the year was £14,529, and the expenditure, including £2,200 written off to depreciation account, amounted to £9,401, leaving a profit of £5,127. The directors recommend a dividend at the rate of 4 per cent. per annum on the ordinary shares, carrying forward £429. The reduction of the charge for electrical energy, which came into operation at the beginning of the year 1906, represents a concession to the consumers of over £2,500, and accounts for the decrease in revenue. The directors are satisfied that the step taken was a proper one. This concession has been appreciated by the consumers, and although it has caused a drop in the dividend, it cannot, in the opinion of the directors, fail to have a good effect upon the development of the business. During the year there was a net increase of lamp connections of the equivalent of 7,687 8-C.P. lamps, bringing up the total connections to the end of the year to the equivalent of 99,033 8-C.P. lamps, including the equivalent of 1,299 H.P. electric motors.

Prospectuses.—*The Urban Electric Supply Co., Ltd.*—This company has been before the public with an issue of a further £75,000 of 4½ per cent. first mortgage debenture stock at 94, the proceeds of which will go to the contractors (Edmundson's Electricity Corporation, Ltd.) for works which have been constructed or are in progress. The list of applications was to close on Wednesday.

Beaufort Borneo Rubber Co., Ltd.—This company is inviting applications until to-day for 73,000 guaranteed £1 shares, interest at 5 per cent. per annum being unconditionally guaranteed for six years by the Chartered Co.

Berlin Elevated and Underground Railway Co.

The tenth year of the existence of this company has just been completed, although the railway itself was only opened for traffic in 1902, and has been slightly extended since that time. Associated with the railway is a level line having a length of 1·36 mile. The latter carried 3,790,000 passengers in 1906 as compared with 3,490,000 persons in 1905 and 1,227,000 in 1902. In the case of the elevated and underground railway, the number of passengers carried last year amounted to 37,810,000, as contrasted with 34,530,000 in 1905 and 18,814,000 in 1902. The length of this—the main—railway in operation in 1906 was 7·8 miles as against 6·9 miles in the preceding year, and the average receipts per passenger were 1½d., or a fraction in excess of the return in 1905. The financial position may be summarised as follows for the past two years:—

	1906.	1905.
Ordinary share capital	£1,500,000	£1,500,000
Loan capital	£750,000	£750,000
Gross profits	£148,544	£125,800
Placed to renewals fund	£20,000	£17,500
Tax paid to City authorities ...	£5,729	—
Depreciation	£3,175	£3,273
Net profits	£85,314	£77,628
Dividend, per cent.	5	4½

The above figures show the combined results for both the elevated and underground railway and the short-level line, the former being worked by 124 motor-cars and trailers. Orders have been given for 12 additional motor-cars and eight trailers, and a new car-shed for 120 coaches is in course of erection. The company possesses its own power station, and eight new boilers and two steam turbines, each of 3,000 H.P. are being provided so as to cope with extensions, and when this plant has been installed the total capacity of the station will be increased to 10,200 H.P. As to the development works in progress, it appears that the extension now in hand from the Potsdamer Platz to the Spistelmarkt will be completed within the period of three years fixed under the agreement. It will be possible to open in the autumn of this year the station at the Leipziger Platz, which will be combined with the existing station at the Potsdamer Platz. The West End extension, of which 1·86 miles have already been finished, will be opened in April, 1908. These developments have necessitated an increase of £500,000 in the share capital, which will first rank for dividend in 1909, whilst a fresh issue for obligations has also been resolved upon.

Potteries Electric Traction Co., Ltd.

Mr. G. F. M. Cornwallis West presided on April 23rd, at Hamilton House, at the annual meeting of this company. In moving the adoption of the report (see Electrical Review, April 19th, page 652) he said that the year had, on the whole, been a satisfactory one. The gross revenue had increased by various causes. The Adderley Green extension had been somewhat of a disappointment to the directors. The greater portion of the increase in receipts had come from the main line, and it was accounted for by the improvement in trade in the district last year. This, however, already shows signs of a decline, mainly attributable to local labour disputes. There was a small increase in the receipts to date. If it had not been for the severe snowstorm about Christmas their receipts would have still further increased by some £500. It cost an extra £500 to keep the service going, so that, in other words, that snowstorm cost the company roughly £1,000. They had carried 1,723,658 more passengers than in 1905. So far as the parcel traffic was concerned last year, this showed a small decrease compared with the previous year, but that item was still useful and considerable. Last year he referred to a satisfactory decrease in power and running expenses. This year the reduction was again substantial, and in spite of the fact of their having taken £4,600 more in gross receipts, the decreased expenditure under this heading was £1,158. Last year he foreshadowed an increase in expenditure under the heading repairs and maintenance. This had proved only too true, and the increased amount was no less than £7,500. Nothing lasted for ever in this world, and tramway permanent way and rolling-stock were certainly no exception to the rule; on the contrary, they were one of the best examples. If electrical engineers 10 years ago had known as much about electric traction as they did now, they would never have suggested the life of permanent way to be from 17 to 20 years, nor would they have used 85 lb. rails, or made a single line with passing places where they might have made a double. However, it was always easy to be wise after the event, and in the meanwhile the directors had had to face the position, and endeavour to find the best way out of it in the interest of the shareholders. Their reserve fund was also called a depreciation fund, but the board unanimously agreed as to the folly of touching this fund for the purpose of finding money for meeting the depreciation of the company's property; on the contrary, they were anxious to add to it as much as possible. It had been suggested that the simplest way of finding money was to pass the ordinary dividend, but he did not consider it fair to the ordinary shareholders to ask them to forego their profits to provide a sum which, although spent in one year, could reasonably legitimately be spread over a number of years; more especially when, by the very spending of that sum, the permanent way dealt with should be in such a good state of repair that the normal expense of upkeep should be somewhat reduced. The directors, after very careful consideration, had decided that the best means of dealing with the situation was to place a sum annually to a new fund, to be called a renewals fund. Last year, out of the total of £18,726 spent in repairs and maintenance, only £1,476 was charged to that fund, and £2,500 had been placed to it. This left £1,000 on the credit side to be carried forward to next year. It was probable that outside the ordinary expenses of upkeep the company would have to spend some £10,000 or £11,000 in renewing part of the permanent way. It was proposed to lay a much heavier rail than heretofore. Assuming the same amount was placed to renewals fund every year, this outlay would be wiped off in four years, it, of course, being carried forward in the shape of a suspense account until such a time. The matter would be treated in a most conservative way, and by far the greater proportion of the expenses on all work done on the permanent way would have to come out of revenue, as was the case now. Where possible, and when it could be proved by figures to be of pecuniary advantage to the company, it would be the policy of the board to double the track, provided, of course, the consents of the local authorities could be obtained. Such doubling would be, of course, a capital expenditure as to half the cost. Turning to capital account, £12,700 was spent. They had purchased five large cars to cope with new extensions and increased traffic. A new car-shed had been built at Fenton on a valuable freehold site. This was necessitated by the great congestion at Stoke depôt—so much so that at nights they actually had cars in the streets, and got into trouble with the local authorities in consequence. Further feeders had been put in which had effected economies in the power stations, and facilitated the running of the cars during the rush hours of busy days. With regard to the general financial position, whereas in 1905 they had a cash balance of £8,235 to their credit, at the end of 1906 they were £3,100 overdrawn at their bankers. The question of finance had caused the board no little anxiety during the year. They were precluded from issuing shares at a discount—their shares were unfortunately at a discount—and unless the articles of association were altered they could not issue any further debenture stock until more shares were issued. In other words, their borrowing powers were limited to one-half the issued share capital. Therefore the board arranged an overdraft with the bankers against the security of their holding in the North Staffordshire Tramways Co. With regard to the extensions, since the issue of the report they had received from the Board of Trade power to abandon the southern half of the Longton-Blythbridge route, and a three years' extension of time for the construction of the remainder. After fully considering the matter, the board were definitely of opinion that these extensions, if constructed, would result in a heavy loss to the company. There had been, practically speaking, no development on these routes, and so far as the Newcastle-Trent Vale route was concerned, they very much doubted whether during the next three years there would be sufficient development to warrant the construction of this line. After expressing regret at the loss of their general manager and engineer, Mr. J. J. Walklate, who had accepted an appointment as general manager and engineer and local attorney with the Auckland Electric Tramways Co., one of the companies associated with the British Electric Traction Co., and mentioning that they had secured the services of Mr. W. Thom as general manager, the chairman formally moved the adoption of the report.

The motion having been seconded, Mr. Tuckett commented upon the directors' changing policy in regard to depreciation. Last year they placed £5,000 to depreciation, because that fund was wholly inadequate and larger provision had to be made. This year they were putting to reserve only £4,140, as against that £5,000, and were carrying forward less than a year ago. The only justification, in his opinion, in going back to that extent on the policy of last year would be the certainty of largely increased revenue during the current year, but he gathered that that was by no means assured, indeed there was every probability of the reverse. There was every probability of repairs and renewals increasing in amount. In the event of their desiring to double the line or to make an extension, it was essential, in connection with any future liabilities or capital commitments, that the company's credit should be re-established, and they were not going about this in the right way if they went back on the moderately sound depreciation policy laid down last year. He had recommended the preference shares to many of his friends, and he considered that they were entitled to feel that their position was a great deal more secure than it was. They had £10,000 net revenue as a margin beyond the preference dividend. In the case of a company with £750,000 capital, that was not a very large margin in view of contingencies. The reserve with this year's provision only amounted to £19,000, or 2½ per cent. on the capital of £750,000 after eight years' working. In the case of tramway companies with practically the whole of their plant subject to very certain and comparatively rapid depreciation, he said that was altogether inadequate. The figures for repairs for the last three years, £8,800, £10,098 and £17,725, only showed the progressive way in which tramway plant was liable to wear and tear, and although it was practically true that they maintained the plant and rolling stock in a sufficient state of repair, that was no answer to his objection that in addition to that they required an adequate reserve to meet the heavy liabilities that would be likely to fall upon them from time to time. The reserve, too, such as it was, was invested in the business, and was not available in cash to meet sudden energency. Last year the chairman said that they had in view the example of the B.E.T. Co., whose chairman laid down an admirable policy with reference to reserve and depreciation, but which he was deplorably deficient in carrying out, and he felt it was necessary to make a protest against the board laying down a policy on one occasion and departing from it on another. The want of a consistent policy shook

the confidence of the public. He proposed that the proposed dividend on the ordinary shares be reduced from 4 per cent. to 3 per cent., and that the amount, £2,450, thereby rendered available be placed to the reserve fund in some way at the discretion of the board.

Mr. Howard Smith, speaking as one of the largest ordinary shareholders, supported the remarks of Mr. Tuckett with regard to the necessity of an increased amount being placed to the depreciation fund each year. Evidently the present sum was utterly inadequate to provide a fund from which could be obtained sufficient monies to reconstruct the line and its rolling stock when it became necessary. The lines were badly constructed, because the weight of rail that should have been used was not used. He spoke as an engineer with a great many years of tramway engineering experience; 84-lb. rails were extremely light. He would have been happy to second Mr. Tuckett's proposition, but he felt that they would not be justified in altering the proposition of the directors in the presence of so few ordinary shareholders.

The Chairman, in his reply, said that the report showed that no less than £6,500 more had been spent in keeping the permanent way better than it was last year. They could not have their cake and eat it. If they put £10,000 to depreciation and reserve fund, the board were perfectly justified in drawing on that fund to keep up the property of the company, but as a board they had decided not to touch it; on the contrary, they had spent a very much larger sum in dealing with the depreciation of the rolling stock and permanent way, and it would be most unfair to ask ordinary shareholders to forego the profits of one year in order to provide some of the money which should be spread over a number of years, such as renewals. At the end of four years the reserve fund would not have to be touched. It would have been added to as far as possible. If the receipts were larger one year, it would be possible to put further sums to depreciation and reserve. It seemed to him a paradox that, providing the efficiency was kept up, so large a sum as suggested should be put to reserve fund. He did not withdraw from the attitude that he took up last year. A great many companies drew on their reserve to meet depreciation. This board would never be a party to that policy. He said, in reply to Mr. Howard Smith, that 90 per cent. of the tramways laid 10 years ago were laid with 85-lb. rails.

The amendment receiving no seconder, the motion for the adoption of the report, with its 4 per cent. dividend, was adopted.

City of Birmingham Tramways Co.

The ordinary general meeting of this company was held on Thursday, April 25th, at Donington House, Mr. Emile Garcke presiding.

The Chairman, in moving the adoption of the report, (see Elec. Rev., April 26th, p. 692), said that owing to the elimination of the omnibus business from the profit and loss account, as the result of the sale of that department to a separate company, both the receipts and expenses showed a diminution. The receipts were £292,197, as against £295,383 in 1905. He was glad to say that the expenses had been reduced in a greater ratio—£191,000 as compared with £200,000 in the previous year. The net profit was substantially larger than the preceding year—£101,131 as against £94,722. Of that sum £12,000 had been applied to the payment of debenture interest, £12,000 to the payment of dividend on the preference shares, and £6,335 to the payment of the dividend on the ordinary shares, leaving a balance of £70,712, which had been added to the reserve fund, which now stood at £431,767, represented by deposits with the trustees of the debenture holders to the extent of £187,134 and by investments £191,870, leaving £64,252 cash in hand and deposits with the Birmingham Corporation. During the year a great change had been made in the mileage of lines owned by the company. Last year they had 33 miles. They had parted with 14½ miles—10¼ of those miles had been worked under leases and 4¼ miles owned by the company and handed over to the Corporation. Thus the company were still working about 19 miles—6 miles in Ashton, 5 miles leased to them by the Corporation and 3 miles by authorities outside the city boundary, and 5 miles owned by the company outside the city. They had 8 miles leased to them until 1911, and it was a very profitable line. These were the cable tramway and the Bristol Road Electric Tramways. Among other assets possessed by the company there were the freehold property and power houses at five depôts and the electrical equipment at another depôt. They had in all 106 electric cars and 58 cable cars. He thought those assets would realise sufficient to pay the capital outlay on them after paying off the debenture and preference shares. They had also sold various properties, including Balsall Heath trams for £20,000, King's Norton for £26,000, Kyott's Lake depôt for £16,000, and the undertaking to Handsworth for £11,000, and the sale of the Moseley and Small Heath depôts, which realised £1,050. Altogether the various properties produced £74,755. If they added to that figure the amount produced by the profit and loss account, £70,712, which had been added to reserve, they would see that they had obtained during the year the total sum of £145,467. They had placed £87,355 to the trustees for the debenture-holders and £89,559 had been added to the investments. They had £400,000 available for the redemption of the debentures and capital. The debentures amounted to £300,000, carrying a 4 per cent. interest, and the money which they invested did not produce as much as they were paying interest on the debentures, the difference amounting to the sum of £3,000 per annum. That was an appreciable sum, and the directors were considering what to do with the available funds. They were unable to pay the debentures off until 1917, unless the company was wound up, when they would have to be paid at par. The directors were considering the question of winding up the company, but it would be rather a pity, as the company still possessed the tenure of several lines, and would hold such leases in some cases for several years to come. The directors were, however, met with the difficulty that if they did not pay off the debentures they would be suffering a loss arising out of the difference on interest that they got from their money that was invested, and the interest they had to pay to the debenture-holders. He would ask the shareholders, however, to leave the matter of winding the company up in abeyance until the directors could lay some scheme before them for dealing with the outstanding matters and the remaining assets. They had endeavoured to do all they could to give the best possible facilities to the travelling public. He was sorry, however, that their efforts to assist the local authorities in that direction had not met with the appreciation they were entitled to expect. They had gone out of their way to give their assistance, but their only reward had been abuse. He thought that was the lot of every company working in conjunction with local authorities.

Mr. J. A. Christie seconded the motion, and the report was adopted.

Wolverhampton District Tramways, Ltd.

The sixth ordinary general meeting of this company was held on Thursday, April 25th, at Donington House, Mr. S. K. Blundstone presiding.

In moving the adoption of the report (see Electrical Review, April 26th, page 692), the Chairman said the accounts were very satisfactory. The gross receipts were £24,279, an increase of nearly £2,000 over the previous year. The net receipts, after charging all expenses, debenture interest, and £500 to depreciation, amounted to £3,997. The expenses showed a decrease in spite of the fact that they had carried half-a-million more passengers than in the previous year. The proportion of working expenses was satisfactory, being a decrease of 5 per cent., they having dropped from 69 per cent. to 64 per cent. The cost of repairs, running and renewals, had increased somewhat. The administration expenses had decreased. The result of the year's working was that they were able to declare a 2 per cent. dividend—an increase of ¾ per cent. over the preceding year, and to place £500 to reserve fund and to carry forward £543. The capital expenditure had increased, and they had spent £1,006 under that heading, chiefly on account of equipping 10 cars with Lorain skates. An arrangement had been made with the Wolverhampton Corporation for through running powers. Intercommunication had also been established between Wolverhampton and Bilston, and with the Walsall Corporation for running powers from Walsall to Willenhall. The working arrangement with the Joint Committee had been renewed, and that company benefited considerably by the arrangement. The receipts for the year compared very favourably with those of last year, and he trusted they would be able to show still better results in the coming year.

Mr. A. C. Miles seconded the resolution, and the report was adopted.

National Electric Construction Co., Ltd.

The report of the directors for 1906 says that the gross profit for the year was £41,715, and deducting therefrom expenses of administration, &c., there remained a balance of £30,035 plus £1,272 brought forward. The directors recommend that there be placed to reserve account £5,000; to reserve against capital charges on town lighting installations, £1,000; to reserve to cover doubtful debts, £1,000; to depreciation on free-wired installations, £4,000; and on furniture, fixtures, plant and tools, £289. A dividend of 10 per cent. is proposed, requiring £17,000; extra remuneration to directors absorbs £675, and there is carried forward £2,343. It is stated that the progress of the undertakings in which the company is financially interested is satisfactory. At Musselburgh, notwithstanding the inclement weather experienced during 1906, the traffic receipts from the tramways were very good, and the lighting undertaking also did well. It is expected that the construction of the extension of the tramways to Port Seton will be commenced this year. Portions of the tramways at Mexborough and Swinton and Torquay have been opened, and the traffic receipts, so far, have been encouraging. Both undertakings should be wholly completed in the course of the next two months. The progress of the Bo'ness and Carnarvon electric light undertakings has been maintained. During the year a contract for the construction and equipment of tramways in the Rhondda Valley was secured, and the work is well in hand. The following tramway concessions have been obtained:—West Yorkshire (connecting Huddersfield with Halifax); Folkestone, Sandgate and Hythe; City of Oxford; and it is considered that these concessions should result in considerable profit to the company. During the year, 31,729 ordinary shares of £1 each were allotted, making the total issued capital £170,000, and an official quotation on the London Stock Exchange was obtained. As the articles of association limit the directors' borrowing powers to one-half of the subscribed capital, the shareholders are asked to pass the necessary resolution to extend these powers, and thus enable the directors to cope with the development of the business. The directors have arranged for an issue of £75,000 in 5 per cent. debentures of £100 each, and the shareholders will be given an opportunity of subscribing for these at £98.

MARKET QUOTATIONS.

Wednesday, May 1st.

	CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a	Acid, Hydrochloric	per cwt.	5/-	..
a	,, Nitric	per cwt.	22/-	..
a	,, Oxalic	per cwt.	32/-	..
a	,, Sulphuric	per cwt.	5/6	..
a	Ammoniac, Sal	per cwt.	42/-	..
a	Ammonia, Muriate (crystal) ..	per ton	£33 10	..
a	,, ,, ...	per ton	£30	..
a	Bleaching powder	per ton	£5 10	..
a	Bisulphide of Carbon	per ton	£18	..
a	Borax	per ton	£15	..
a	Copper Sulphate	per ton	£32 10	..
a	Lead, Nitrate	per ton	£34 10	..
a	,, White Sugar	per ton	£35	..
a	,, Peroxide	per ton	£32	..
a	Methylated Spirit	per gal.	2/6	..
a	Potassium Bichromate, in casks	per lb.	3½d.	..
a	Potash, Caustic (75/80 %) ..	per ton	£20	..
a	,, Chlorate	per lb.	3½d.	..
a	,, Perchlorate	per lb.	9d.	..
a	Potassium Cyanide	per lb.	7½d.	..
a	Shellac	per cwt.	220/-	..
a	Sulphate of Magnesia	per ton	£4 10	..
a	Sulphur, Sublimed Flowers ..	per ton	£6 10	..
a	,, Recovered	per ton	£5 10	..
a	,, Lump	per ton	£5	..
a	Soda, Caustic (white 70 %) ..	per ton	£10 15	..
a	,, Chlorate	per lb.	3½d.	..
a	,, Crystals	per ton	£5 5	..
a	Sodium Bichromate, casks ..	per lb.	3d.	..
a	,, Cyanide (basis 100 %) ..	per lb.	7d.	..
	METALS, &c.			
b	Aluminium Ingots, in ton lots ..	per ton	£200	..
b	,, Wire, in ton lots ..	per ton	£220	..
b	,, Sheet, in ton lots ..	per ton	£210	..
p	Babbitt's metal ingots	per ton	£61 to £203	..
c	Brass (rolled metal 2" to 12") basis	per lb.	11¼d.	¼d. inc.
c	,, Tube (brazed)	per lb.	1/0½	..
c	,, ,, (solid drawn)	per lb.	11¾d.	..
c	,, Wire, basis	per lb.	11d.	¼d. inc.
c	Copper Tubes (brazed)	per lb.	1/2	..
c	,, ,, (solid drawn) ..	per lb.	1/2½	..
g	Copper Bars (best selected) ..	per ton	£118	..
g	Copper Sheet	per ton	£116	..
g	,, Rod	per ton	£118	..
e	,, (Electrolytic) Bars ..	per ton	£117	..
e	,, ,, Sheets ..	per ton	£125	..
e	,, ,, Rod ..	per ton	£123	..
	,, ,, H.C. Wire ..	per lb.	1/2¼	..
	Ebonite Rod	per lb.	3/8	..
	,, Sheet	per lb.	8/-	..
n	German Silver Wire	per lb.	1/8	..
h	Gutta-percha, fine	per lb.	6/- to 7/-	..
h	India-rubber, Para fine	per lb.	4/11	¼d. dec.
i	Iron, Charcoal Sheets	per ton	£18	..
i	,, Pig (Cleveland warrants)	per ton	57/11	2/4½d. inc.
i	,, Forgings, according to size	per ton	From £11	..
i	,, Scrap, heavy	per ton	47/6 to 50/-	..
	,, Wire, galvanised No. 8 ..	per ton	£9 15	..
	Lead, English Ingot	per ton	£20 13 9	Inc.
g	,, ,, Sheet	per ton	£21 5 to £21 10	..
m	Manganin Wire No. 28	per lb.	8/	..
g	Mercury	per bot.	£7	..
d	Mica (in original cases) small ..	per lb.	6d. to 1/-	..
d	,, ,, ,, medium	per lb.	2/6 to 4/-	..
d	,, ,, ,, large ..	per lb.	4/6 to 8/6	..
p	Phosphor Bronze, plain castings	per lb.	1/4½ to 1/6½	..
p	,, rolled bars & rods	per lb.	1/5½ to 1/6½	..
p	,, ,, strip & sheet	per lb.	1/6 to 1/10	..
o	Platinum	per oz.	..	..
e	Silicium Bronze Wire	per lb.	1/8½	..
t	Steel, Magnet, acc'd'g to desc'p'n	per ton	£58	..
	,, ,, in bars		£15 to £40	..
	Tin, Block (English)	per ton	£198 to £200	£8 inc.
n	,, Wire, Nos. 1 to 16	per lb.	2/4	..
p	White Anti-friction Metals—			
	"White Ant" brand	per ton	£61 to £85	..
k	Zinc, Sh't (Vieille Montagne bnd.)	per ton	£30 10	..

Quotations supplied by:—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, G.P. and Teleg. Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd.
p The Phosphor Bronze Co., Ltd.

Babcock & Wilcox, Ltd.—Mr. John Dewrance presided at Cannon Street Hotel on 25th ult. over the meeting of this company, and in moving the adoption of the report (see ELECTRICAL REVIEW, April 26th, page 691), he said that gas power had not materially interfered with their profits. Their trade in small plant had, however, been reduced by the small user adopting gas and electric power. For boilers of large powers there was no appreciable falling off. Extensions of the works were in progress to cope with the increased volume of business handled. The report was adopted.

City of Buenos Ayres Tramways Co. (1904), Ltd.—The directors have declared a dividend of 1s. 3d. per share, less income-tax, for the three months ended March 31st last.

STOCKS AND SHARES.

Tuesday Evening.

BUSINESS has fallen into very humdrum lines in the Stock Exchange. The reduction of the Bank Rate from 5 per cent. to 4 per cent., within a fortnight, afforded markets no assistance whatever. There are too many new, gilt-edged issues on the war-path to enable Consols to advance; so far, the gilt-edged are about the only fresh emissions that have braved the public apathy to investment attractions.

One exception, however—and perhaps it is almost sufficiently high-class in character not to be called an exception—is the new issue of 4½ per cent. Debenture stock at 94 by the Urban Electric Supply Company. The stock forms part of the Debenture issue, some of which is already in the hands of the public, the existing amount being quoted at 95 to 98. Business was done on Monday at 95, which, no doubt, means a sale by some holder who wants to exchange into the new, because of the slight "turn" there is to be made in so doing.

The issue is underwritten, but it is hoped that there will be a fair amount of public response, for several reasons. For one thing, the new money will help not the Urban Company alone, but also Edmundson's, through which latter the Lancashire Power undertaking would be indirectly benefited, too. The last-named, we understand, is doing better than it has been for some time past.

Electricity varieties are all but motionless. Charing Cross Ordinary continue to plod upwards, and the price has reached £4 middle. City of London Ordinary weakened a shade, while Brompton's put on ¼. An improvement to 6⅛ in Oxfords concludes the list of attractions amongst the shares, and the Debenture stocks are mostly marked by *ex* dividend changes only. But Edmundson's Debenture was lowered 2 points to 88½.

Metropolitan Railway stock is moving sharply and erratically. It has been down to 43½ and up to 46½ within the last few days, standing now at about 46. A group of speculators is wire-pulling the price, and when their bidding brings in sellers of the stock, they allow the quotation to suddenly break. Districts are quiet at 14. Of the electrical railways proper, none have changed since we last wrote. There is, however, a depressed tone about the market generally, which does not bode well for any of its securities.

Several of the traction descriptions have declined. British Electric Traction Ordinary are down to 2¾, the Preference to 6¾, the first showing a drop of 10s., the second of 5s. this week. The market is void of any sort of support, and no hope of a July dividend on the Ordinary is entertained. The Argentine division gave way a little. Anglo-Argentine Ordinary at 7⅜ are ⅛ lower, and Belgranos are a fraction down. Potteries, with 1/16 loss at 10s., are *ex* 9¾d. dividend. Calcutta trams have been put down to 8, *ex* their dividend of 4s. 6d. per share.

Slight activity is noticeable in the 7 per cent. Preferred Ordinary shares of the General Motor-Cab Company, and the price is 21s. to 22s. They are £1 shares, fully paid.

Telegraphs have taken a turn for the better, though movements are somewhat irregular. Anglo-American Deferred at 21¼ is weak, despite the strength of the American Railroad section. The Preferred has risen ⅜ to 107¼. Direct United States shares recovered from their previous dulness, and Indo-Europeans are ½ better at 59½. The progress of the West India and Panama Company continues to be reflected in advances in the price of the shares. Several prior-charge stocks improved upon investment inquiry that followed the reduction in the Bank Rate.

National Telephones are practically stationary. The Third Preference yielded 7/16 to 5 7/16, otherwise the group has not moved. Oriental Telephone Ordinary are *ex* 9⅜d., and remain at 27s. 6d. Monte Video Telephone Preference eased off to 18s. 9d. upon deduction of the dividend.

There is a Stock Exchange fable to the effect that cases sometimes occur in which the only time a price is altered is when *ex* dividend markings take place. This being so, it follows that in course of logical sequence, the quotation shrinks, by the amount of half-yearly dividend at a time, to exactly zero. After this, imagination has to supply the gap. Judging from the immobility of certain electrical securities—but perhaps 'twere kinder not to judge.

F. Reddaway & Co., Ltd.—The directors report a profit for the past year of £51,517, against £40,851 in 1905-6. Of this sum £5,775 is to be applied to depreciation of mills and machinery, and £15,000 is set aside to meet interest and legal expenses. The balance (£29,758) will, with the sum brought forward from last year, make the amount disposable £32,736. A dividend of 6 per cent. on the preference shares (absorbing £10,350) is recommended; £20,000 of the balance is to go to the reserve fund (bringing it up to £85,000); and the residue (£2,386) will be carried forward

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. †	Dividends for the last four years. 1903.	1904.	1905.	1906.	Closing Quotations April 23rd.	Closing Quotations April 30th.	Business done week ended April 30th, 1907. Highest	Lowest.	Rise + or Fall —	Present Yield per cent. £ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3 — 3½	3 — 3½	..	..	..	Nil
149 600	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	b %	5 %	88 — 91	88 — 91	..	..	..	5 9 11
660,660	Anglo-American Telegraph	Stock	6ls.	2½%	3½%	3½%	61 — 64 xd	61 — 64	..	..	..	6 1 1
3,169,670	Do. do. do. 6 % Pref.	Stock	6 %	5½%	6 %	6 %	106 —107 xd	106½—107½	107⅞	106	+ ⅜	5 11 4
3,169,670	Do. do. do. Deferred	Stock	2s.	Nil	1½%	1¾%	21⅞— 22⅛	22⅛— 22⅜	22 5/16	21 5/16	+ ¼	7 15 7
50,000	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	..	..	5 %	..	99 —101	99 —101	..	..	..	4 19 0
44,000	Chili Telephone, Nos. 1 to 44,000	5	7 %	8 %	8 %	..	6½— 7½	6½— 7½	..	..	..	5 10 4
2,097,680	Commercial Cable Stlng. 500 year 4 % Deb. Stk. Red.	Stock	4 %	4 %	4 %	4 %	93 — 95	93 — 95 xd	94	..	..	4 4 3
16,000	Cuba Telegraph	10	0 %	5 %	5 %	5 %	8½— 8¾	8 — 8½	..	..	— ¼	5 17 8
6,000	Do. 10 % Pref.	10	15 %	10 %	10 %	10 %	16½— 17½	16 — 17	..	..	— ½	5 17 8
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %	3⅝— 3¾	3⅝— 3¾ xd	..	..	..	5 8 6
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	8½— 9⅛	8½— 9¼ xd	..	..	..	5 8 1
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
60,710	Direct United States Cable	20	8 %	8½%	4½%	..	14½— 15½	15⅛— 15⅝	17⅝	14⅞	+ ⅜	5 7 11
60,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	..	137 —142	137 —142	146⅜	138	..	4 18 7
2,000,000	Do. 8½ % Pref. Stock	100	8½%	8½%	8½%	..	87½— 89½	88½— 90½	89½	88⅜	+1	3 17 4
1,896,706	Do. 4 % Mort. Deb. Stock Red. ..	Stock	4 %	4 %	4 %	..	106 —108	104½—106 xd	104⅛	..	..	3 15 2
800,000	Eastern Extension, Australasia, and China Tele.	10	7 %	7 %	7 %	..	13½— 13⅝	13½— 13⅝	13 15/16	13⅜	..	5 1 10
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	105 —107	105 —107	106½	..	..	3 14 9
295,400	East & S. Afric. Tel., 4 % Mt. Db., 1 to 8,000, red. 1909	100	4 %	4 %	4 %	4 %	99 —101	98 —101	..	..	..	3 19 3
200,000	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	..	10¾— 11	10¾— 11	10 15/16	..	..	6 0 0
181,127	Do. do. 6 % Pref	10	6 %	6 %	6 %	..	13½— 14½	13½— 14½	14⅛	13 15/16	..	4 4 3
150,000	Great Northern Telegraph, of Copenhagen ..	10	15 %	24 %	24%	20 %	85 — 87	85 — 87	86½	..	..	5 6 8
23,500	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	99 —101	99 —101	..	..	..	4 9 1
17,000	Indo-European Telegraph	25	10 %	13 %	13 %	13 %	58 — 60	58½— 60½	59⅞	..	+ ⅛	5 7 5
256,127	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	⅜— ½	⅜— ½	..	..	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord. ..	1	8 %	4 %	5 %	..	1 1/16— 1 1/16	1 1/16— 1 1/16	..	..	..	4 14 1
86,492	Do. do. do. 5 % Pref. ..	1	5 %	5 %	5 %	..	⅞— 1 1/16	⅞— 1	..	..	— 1/16	5 0 0
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	108 —110	108 — 110	109½	108½	..	5 9 1
2,225 000	Do. do. Def. Stock	100	5 %	5 %	5 %	5½ %	104½—106½	104½ — 106½	105⅝	104⅜	..	5 3 4
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %	11½— 12½	11½— 12½	..	..	..	4 8 11
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	5 %	10 — 12	10 — 12	11	..	..	4 8 4
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜— 5⅝	5⅜— 5⅝	5 5/16	5 3/16	— 1/16	4 9 11
2,000,000	Do. do. 8½ % Deb. Stock Red. ..	Stock	8½%	8½%	8½%	8½%	96 — 98	96 — 98	9 3/8	9 3/16	..	3 14 6
1,689,598	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	100 —102	100 —102	101½	100⅞	..	3 18 5
179,818	Oriental Telep. and Elec. 1 to 171,604, fully paid	1	6¾%	6¾%	7¾%	7 %	1⅝— 1 7/8	1⅝— 1 7/8	..	..	..	5 4 4
50,000	Do. do. do. 6 % Cum. Pref. ..	1	6 %	6 %	6 %	6 %	1½— 1½	1½— 1½	..	..	..	4 16 0
100,000	Do. do. do. 4% Red. Deb. Stock	100	..	..	4 %	4 %	95 — 98	95 — 98	..	..	..	4 1 8
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	4 %	97 —100	98 —101	..	..	+1	3 19 3
11,889	Reuter's	8	5 %	5 %	5 %	..	7½— 8½	7½— 8½	..	..	..	4 17 7
60,000	Telephone Co. of Egypt, 4½ % Deb. Red.	100	..	..	4½%	4½%	99 —102	99 —102	..	..	..	4 8 3
3,167	Submarine Cables Trust	Cert	6 %	6 %	6 %	6 %	155 —158 xd	125 —128	..	..	..	4 13 9
80,000	United River Plate Telephone	5	8 %	8 %	8 %	..	6¾— 7½	6¾— 7½	7	6 13/16	..	5 10 4
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5 — 5½	5 — 5½	..	..	..	4 15 3
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	5 %	109 —112	109 —112	..	..	..	4 9 3
15,609	West African Telegraph, Shares	10	4 %	4½%	4 %	..	10 — 10½	10 — 10½	..	..	..	3 16 2
80,008	W. Coast of America, 1 to 80,000 & 58,001 to 58,008	2	Nil	Nil	Nil	..	⅜— ½	⅜— ½	..	..	..	Nil
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	4 %	99 —102	99 —102	..	..	..	3 18 5
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980 ..	10	7 %	7 %	7 %	..	13⅜— 14⅛	13⅜— 14⅛	14	13¾	..	4 19 1
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —104	102 —105	..	..	+1	3 16 2
88,821	West India and Panama Telegraph	10	Nil	Nil	Nil	..	⅜— 1/16	⅜— 1/16	13/16	11/16	..	Nil
84,568	Do. do. 6 % Cum. 1st Pref.	10	7 %*	6 %	5 %	..	⅞— 8	⅞— 8	7/8	..	+ 1/16	6 1 3
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	..	6 — 7	6¼— 7¼	..	..	+ ¼	Nil
80,000‖	Do. do. 5 % Debs., Nos. 1 to 1,600 ..	100	5 %	5 %	5 %	5 %	99—102	100 —103	..	..	+1	4 17 1

‖ Including arrears

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

270,000	Anglo-Argentine Trams, Nos. 260,008 to 510,007, and 560,008 to 580,007	..	..	8 %	8 %	8 %	7⅞— 7⅞ xd	7¼— 7½	7 5/16	7¼	— ⅛	5 6 8
260,007	Do. 5½ % Cum. Prefs., 1 to 260,007 ..	5	5½%	5½%	5½%	5½%	5 11/16— 5 15/16	5 15/16— 6	5 15/16	5 13/16	+ 1/16	4 11 8
266,800	Do. Permanent, 6 % Deb. Stock, 1888	100	6 %	6 %	6 %	6 %	132 —135	132 —135	..	..	..	4 8 11
285,100	Auckland E. Trams., 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	104 —107	104 —107	..	..	..	4 13 6
880,000	Babcock & Wilcox, 1 to 880,000	1	17 %	20 %	20 %	20 %	3⅞— 4⅛	3⅞— 4	80/-	78/1½	— ⅛	5 0 0
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 7/16— 1 1/2	1 1/16— 1 1/8 xd	..	..	..	8 15 7
88,000	British Aluminium, Ord., 2,001 to 40,000	5	..	7 %	7 %	..	5¼— 5¾	5¼— 5⅝	5⅜	..	..	6 1 9
40,000	Do. do. 7 % Cum. Pref.	5	Nil	7 %	7 %	..	5¾— 6⅛	5¾— 6⅛	6	5⅞	..	5 12 0
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	6 %	6 %	..	5¼— 5⅝	5¼— 5⅝	..	..	..	5 4 4
20,000	Do. do. 4 % Funding Certs.	5	..	4 %	4 %	..	4 — 4⅜	4 — 4⅜	..	..	..	4 8 11
258,000	Do. do. 5 % 1st Mort. Deb. Stock Red.	Stock	5 %	5 %	5 %	..	101 —105	101 —105	..	..	..	5 8 11
800,000	Do. do. 5½ % Loch Leven Debs. ..	100	..	..	..	5½%	98 —101	98 —101	..	..	..	4 15 3
400,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	6 %	6 %	6 %	126 —130	123 —127 xd	128½	125	..	4 14 6
800,000	Do. 5 % Pref. Ord. Stock	100	5 %	5 %	5 %	5 %	106 —111	106 —111	..	..	..	4 10 1
800,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	102 —106	102 —106	104½	..	..	4 14 4
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	99 —101 xd	99 —101	..	..	..	4 8 3
290,000	Do. 4½ % Vancouver Power Debs., 1 to 2,900	100	4½%	4½%	4½%	4½%	102½—104½	102½—104½	..	..	..	4 9 1
188,801	British Electric Traction	10	6 %	6 %	3 %	..	3 — 3½	2½— 3	60/-	55/-	— ½	10 0 0
161,487	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	6¾— 7¼	6¾— 7	7	6¾	— ¼	8 11 5
1,448,653	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	10 —105	101 —105	..	..	..	4 15 3
410,178	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	4½%	4½%	..	81 — 84	79 — 82 xd	..	..	..	5 9 1
100,000	British Insulated and Helsby Cables	5	8 %	8 %	8 %	10 %	6¾— 7	6¾— 7	..	..	..	7 2 1
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	5¾— 6¼	5¾— 6¼	6¼	..	..	4 16 0
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%	101 —104	102 —105	..	..	+1	4 5 9
212,000	British Thomson-Houston 4½ % 1st Mort. Debs. ..	100	4½%	4½%	4½%	..	92 — 96	94 — 98	..	..	+2	4 11 10
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	6 %	Nil	Nil	..	1 — 1½	1 — 1½	25/-	23/9	..	Nil
1,016,853	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	65 — 69	65 — 69	..	..	..	5 15 11
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	⅞— 1 1/16	1 1/16— 1 1/8	..	..	..	Nil
50,000	¶ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
105,731	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	2½%	..	⅝— ¾	⅝— ¾	..	..	..	5 14 3
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	..	1¼— 1½	1¼— 1½	31/3	30/7½	..	6 17 2
125,000	Do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	89 — 92	89 — 92	..	..	..	4 17 10
125,000	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	4½%	75 — 78	75 — 78	..	..	..	5 15 5
100,000	Buenos Ayres & Belgrano, 1 to 100,000	5	3 %	4 %	3 %	3 %	3½— 4	3⅝— 3¾	72/6	70/-	— ⅛	3 17 5
40,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	6 %	6 %	6 %	6 %	5 — 5⅛	5 — 5⅛	5 1/16	5	..	5 14 3
27,500	Do "B" do. 1 to 27,500	5	6 %	6 %	6 %	6 %	4⅞— 5⅛	4⅞— 5⅛	..	..	..	5 12 11
18,200	Do. 5 % Deb. Stock	100	5 %	5 %	5 %	5 %	104 —106	104 —106	..	..	..	4 14 4
190,000	Do. 5 % 2nd Deb. Stock	100	5 %	5 %	5 %	5 %	101 —104	101 —104	..	..	..	4 16 2
137,610	Calcutta Trams., 1 to 137,610	5	6 %	8 %	8 %	8 %	8 — 8½	7⅞— 8¼	7⅞	..	— ¼	4 17 0
80,000	Do. 5 % Cum. Pref., Nos. 1 to 29,330	5	..	..	5 %	5 %	5¼— 5⅝	5¼— 5⅝	..	..	..	4 6 11
350,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	105 —108	105 —108	..	..	..	4 3 4
85,000	Callender's Cable Construction shares	5	12½%	12½%	15%	..	10½— 11½	10½— 11½	10 5/8	10 1/8	..	7 2 10
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5½— 5⅝	5½— 5⅝	..	..	..	4 6 11
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	106 —108	106 —108	..	..	..	4 3 4
491,222	Cape E. Trams., 1 to 491,222	1	10 %	5 %	Nil	..	1/16— 3/16	1/16— 3/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	1	4 %	4 %	6 %	..	1 3/16— 1 1/8	1 3/16— 1 1/8	..	..	..	4 11 5
224,988	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4½%	..	97 —102	97 —102	..	..	..	4 8 3
911,568	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %	75 — 77	75 — 77	75½	..	..	5 3 11
544,216	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	92 — 94	92 — 94	93½	..	..	4 5 1
544,216	Do. do. Def. do.	Stock	4 %	4 %	4 %	4 %	57 — 60	57 — 60	..	..	+1	6 13 4
1,460,000	City and South London Railway	Stock	2¾%	2½%	1⅞%	2½%	41 — 43	41 — 43	42⅜	42 1/16	..	4 18 10
85,000	Crompton & Co., Nos. 1 to 85,000	5	2½%	2½%	2½%	..	1⅞— 2⅛	1⅞— 2⅛	37/6	..	..	3 10 2
100,000‖	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	..	5 %	5 %	5 %	96 — 99	96 — 99	97	..	..	5 1 0

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated, all shares are fully paid. § Interim dividends.
‖ And bonus of 10s. ¶ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued.)*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(Continued.)*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years.				Closing Quotations April 23rd.	Closing Quotations April 30th.	Business done week ended April 30th, 1907.		Rise + or Fall —	Present Yield per cent.
		†	1903.	1904.	1905.	1906.			Highest	Lowest.		£ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	1	..	10 %	10 %	..	1½ — 1¾	1½ — 1¾	..	..	..	6 13 4
805,000	Do. do. 6 % Cum. Pref., 1 to 805,000 ..	1	6 %	6 %	6 %		1 29/32 — 1 31/32	1 29/32 — 1 31/32	..	..	..	4 19 0
294,150	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	101 — 104	101 —104	..	..	..	4 6 7
60,000	Dublin United Trams. (1896), 1 to 60,000 ..	10	5½ %	6 %	6 %	..	14½ — 15½	14½ — 15½	..	..	..	3 18 8
59,987	Do. 6% Pref. between 1 and 60,000	10	6 %	6 %	6 %	..	13 29/32 — 14 3/32	13½ — 14⅜	13½	..	— ½	4 2 9
99,961	Edison & Swan Utd., "A" shrs., £8 pd., 1 to 99,961	5	Nil	2½ %	4 3/16 %	..	1 29/32 — 1 31/32	1½ — 1 31/32	..	..	..	9 3 9
17,189	Do. "A" shares, 01—017,189 ..	5	Nil	2½ %	4 3/16 %	..	2 29/32 — 2 31/32	2 29/32 — 2 31/32	..	..	..	8 6 9
319,475	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	85 — 87	85 — 87	..	..	..	4 12 0
72,220	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	89 — 92	88 — 92	..	..	— ½	5 8 8
112,100	Electric Construction 1 to 112,100	2	4 %	Nil	Nil	..	5/16 — 7/16	5/16 — 7/16	..	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	..	1 29/32 — 2	1 29/32 — 2	..	..	..	7 0 0
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Stk.	Stock	4 %	4 %	4 %	4 %	81 — 84	81 — 84	..	..	..	4 15 8
25,000	General Electric Co. (1900), 5 % Cum. Pref. ..	10	5 %	5 %	5 %	5 %	8 7/8 — 9 3/8	8 7/8 — 9 3/8	..	..	..	5 2 4
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	4 %	92 — 95	92 — 95 xd	..	..	..	4 4 3
78,000	Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 78,000	10	3 %	4 %	4 %	4 %	2½ — 3	2½ — 3	..	..	..	11 0 0
96,000	Greenwood & Batley 7 % Cum. Pref.	10	7 %	7 %	7 %	7 %	10½ — 10¾	10½ — 10¾	..	..	..	6 13 4
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	5 %	102 —108	102 —103	..	..	..	4 17 1
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15%	15 %	12 — 13	12 — 13	..	..	..	5 15 5
200,000	Do. do. 4½ % Pref.	5	4½ %	4½ %	4½ %	4½ %	5½ — 6¾	5½ — 6¾	..	..	..	3 15 7
150,000	Do. do. 4½ Mort. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	107 —109	107 —109	107½	..	..	4 2 7
50,000	India-Rubber, Gutta-Percha & Telegraph Works..	10	10%	5 %	10%	10 %	15½ — 16½	15½ — 16½	..	..	..	6 3 1
37,500	†Liverpool Overhead Railway, Ord.	10	18%	11½ %	Nil	Nil	1½ — 1¾	1½ — 1¾	..	..	..	Nil
10,000	† Do. do. Pref. £10 paid	10	5 %	5 %	5 %	5 %	6 — 7	6 — 7	..	..	..	7 8 2
600,070	London United Trams (1901), 1 to 50,007 ..	10	8 %	6 %	8 %	8 %	7 — 8	7 — 8	..	..	..	8 15 6
999,980	Do. do. 60,008 to 100,000 ..	10	8 %	6 %	8 %	8 %	7 — 7½	7 — 7½	..	..	..	5 2 2
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000 ..	10	5 %	5 %	5 %	5 %	7 29/32 — 8 3/32	7 29/32 — 8 3/32	..	..	..	5 14 3
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock ..	100	4 %	4 %	4 %	4 %	84 — 89	84 — 89	86 7/8	..	..	4 9 11
314,016	Metropolitan Electric Trams, Defd.	1	Nil	Nil	Nil	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
500,000	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	27/32 — 31/32	27/32 — 31/32	..	..	..	5 3 11
850,000	Do. 4½ % Deb. Stock Red.	100	..	4½ %	4½ %	4½ %	96 — 99	96 — 99	97½	96½	..	4 10 11
80,000	Peebles (B.) & Co. 6 % Cum. Pref., 20,001 to 50,000	5	..	6 %	6 %	6 %	4 — 4½ xd	4 — 4½	..	..	..	7 10 0
245,500	Potteries E. Tro.	1	5 %	5 %	4 %	4 %	7/16 — 9/16	3/8 — 7/16 xd	..	..	..	6 8 0
245,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	3/4 — 7/8	3/4 — 7/8	..	..	..	6 13 4
245,000	Do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	98½ —101½	98½ —101½	..	..	..	4 8 8
37,850	Telegraph Construction and Maintenance	12	20 %	15 %	15 %	15 %	29 — 31	29½ — 31½	31	30½	+ ½	5 14 8
150,000‡	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1900	100	4 %	4 %	4 %	4 %	100 —108	100 —103	..	..	..	3 17 8
599,300	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	..	..	5 %	5 %	76 — 79	76 — 79	..	..	..	6 6 7
66,666	Willans & Robinson, 1 to 80,000 & 80,001 to 116,666	5	8 %	Nil	Nil	..	1½ — 1¾	1½ — 1¾	..	..	..	Nil
66,666	Do. 6 % C. P., 80,001 to 80,000 & 125,001 to 141,666	5	6 %	Nil	Nil	..	3½ — 4½	3½ — 4½	80/-	..	..	Nil
246,574	Do. 4 % 1st Mort. Deb. Stock	100	4 %	4 %	4 %	4 %	79 — 83	79 — 83	79½	79½	..	4 16 5

ELECTRICITY SUPPLY COMPANIES.

14,000	Bromley (Kent) E.L. & P., 1 to 14,000	5	5 %	5 1/16 %	5 1/16 %	5 1/16 %	4 7/8 — 5 1/8	4 7/8 — 5 1/8	..	..	..	5 4 9
70,000	Do. do. 4½ % 1st. deb. stock ..	100	4½ %	4½ %	4½ %	4½ %	99 —101	97 — 99 xd	..	..	..	4 10 11
29,798	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10 %	10 %	10 %	10%	7½ — 8½	7 7/8 — 8 3/8	..	..	+ ¼	5 14 3
10,302	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 8	7 — 8	..	..	..	4 7 6
836,876	Central Electric Supply 4 % Guar. Deb. Stock ..	100	4 %	4 %	4 %	4 %	100 —108	100 —103	..	..	..	3 17 8
80,000	Charing Cross and Strand Electricity Supply ..	5	8 %	8 %	5 %	5 %	3½ — 4½	3½ — 4½	82/6	..	+ ½	5 11 1
80,000	Do. do. 4½ % Cum. Pref.	5	4½ %	4½ %	4½ %	4½ %	4 — 4½	4 — 4½	..	..	..	5 0 0
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½ %	4½ %	4½ %	4½ %	3½ — 4½	3½ — 4½	..	..	..	5 5 11
427,400	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
49,486	Chelsea Electricity Supply, Ord.	5	5½ %	6 %	6 %	4½ %	3½ — 4½	3½ — 4½	..	..	..	4 14 9
175,000‡	Do. do. 4½ % Deb. Stock Red.	Stock	4½ %	4½ %	4½ %	4½ %	104 —107	104 —107	..	..	..	4 4 1
70,596	City of London Elec. Lighting, Ord. 40,001—110,596	10	5 %	6 %	6 %	6 %	9 7/8 — 10 3/8	9 7/8 — 10 3/8	10 1/8	10	— ⅛	5 14 3
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	11 3/4 — 12 1/4	11 3/4 — 12 1/4	12 1/8	12	..	4 18 0
400,000‡	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	5 %	122 —125	122 —125	..	..	..	4 0 0
800,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½ %	4½ %	4½ %	4½ %	97 —100	97 —100	99	..	..	4 10 0
40,000	County of Durham Electrical Power, Ord.	5	4 %	£3 7 0	4 %	4 %	4½ — 5	4½ — 5	..	..	..	4 0 0
50,000	Do. do. 5 % Pref. ..	5	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	..	..	..	5 0 0
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4½ %	5 %	5 %	8 — 8½	8 — 8½	..	..	..	5 17 8
40,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10½ — 11½	10½ — 11½	10⅞	..	..	5 4 4
400,000‡	Do. do. 4½ % Deb. Stock ..	..	4½ %	4½ %	4½ %	4½ %	106 —109	106 —109	..	..	..	4 2 7
400,000	Do. do. 4½ % 2nd Deb. Stock ..	Stock	4½ %	4½ %	4½ %	4½ %	97 —100	95 — 98 xd	..	..	..	4 11 10
80,000	Edmundson's Electric Corporation, Ord. Shares ..	5	7 %	7 %	4 %	..	1 — 2	1 — 2	27/6	..	..	10 0 0
80,000	Do. do. 6 % Cum. Pref... ..	5	6 %	6 %	6 %	..	2½ — 3½	2½ — 3½	60/-	..	..	8 11 5
850,000	Do. do. 4½ % 1st Mort Deb. Stk	100	4½ %	4½ %	4½ %	4½ %	89 — 92	87 — 89	..	..	—2	5 1 2
10,000	Folkestone, 1 to 10,000	5	5½ %	5½ %	5½ %	5½ %	4 7/8 — 5 3/8 xd	4 7/8 — 5 3/8	..	..	..	5 2 4
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	5 %	5 %	5 — 5½	5 — 5½	..	..	..	4 15 3
90,000	Do. 4½ % 1st. Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	97 —100	97 —100	..	..	..	4 10 0
18,000	Hove, 1 to 18,000	5	8½ %	8½ %	9 %	9 %	7 — 7⅛ xd	7 — 7⅛	7⅜	7¼	..	6 0 0
21,000	Kensington and Knightsbridge Electric Ord. ..	5	13½ %	12 %	10 %	10 %	8½ — 9¼	8½ — 9⅜	..	..	..	5 0 0
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	3 %	4 %	4 %	1½ — 2½	1½ — 2½	..	..	..	5 6 8
70,000	Do. do. do. 6 % Pref...	5	6 %	6 %	6 %	6 %	4½ — 5½	4½ — 5½	..	..	..	5 14 3
874,895	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	4½ %	95 — 98	95 — 98	..	..	..	4 11 10
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8½ %	10 %	10 %	8 %	6 — 7	6 — 7	6⅝	..	..	5 14 4
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½ %	4½ %	4½ %	4½ %	4 7/8 — 5⅜	4 7/8 — 5⅜	5 5/32	..	..	4 8 9
220,000‡	Do. 4½ % 1st Mort. Deben. Stock	..	4½ %	4½ %	4½ %	4½ %	106 —110	106 —110	..	..	..	4 1 10
250,000‡	Do. 3½ % Mort. Deben. Stock Redeem.	Stock	3½ %	3½ %	3½ %	3½ %	90 — 93	90 — 93	89	..	..	3 15 3
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½ %	4½ %	4½ %	4½ %	95 — 98	95 — 98	..	..	..	4 11 10
67,991	Newcastle-on-Tyne	5	8 %	8 %	8 %	8 %	7½ — 7⅞	7½ — 7⅞	..	..	..	5 3 3
75,000	Do. 5 % Pref., 1 to 75,000	5	5%	5 %	5 %	5 %	5 — 6	5 — 6	..	..	..	4 3 4
10,852	Notting Hill Electric Lighting	10	6 %	7 %	7½ %	7½ %	12 — 13	12 — 13	..	..	..	5 15 5
64,000	Do. do. 4 % 1st Mort.Deb... ..	100	4 %	4 %	4 %	4 %	96 — 99	96 — 99	..	..	..	4 0 10
20,000	Oxford, 1 to 96 and 407 to 20,310	5	6¼ %	7 %	7 %	7 %	5⅝ — 6¼	5¾ — 6⅜	..	..	+ ⅛	5 9 10
50,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	96 — 98	96 — 98	..	..	..	4 1 8
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½ %	14½ %	12½ %	10 %	7⅞ — 8⅛	7⅞ — 8⅛	8 1/8	7⅞	..	5 17 8
20,000	Do. do. 7 % Pref. 50,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅞ — 7⅞	6⅞ — 7⅞	..	..	..	4 13 4
150,000‡	Do. do. 3¾ % Deb. Stock Red. ..	100	3¾ %	3¾ %	3¾ %	3¾ %	93 — 95	93 — 95	..	..	..	3 13 8
12,000	Smithfield Markets Electric Supply, Ord.	5	4 %	4 %	4 %	Nil	1½ — 2½	1½ — 2½	..	..	..	Nil
60,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	73 — 77	73 — 77	..	..	..	5 3 11
65,000	South London Electricity Supply, Ord.	5	8 %	4 %	4 %	3 %	2½ — 2⅝	2½ — 2⅝	..	..	..	5 9 1
120,000	South Met. Elec. Lt. & Power, Ord.	1	Nil	Nil	2½ %	2½ %	7/8 — 1	7/8 — 1	..	..	..	3 6 8
117,988	Do. Do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1⅛ — 1⅜	1⅛ — 1⅜	..	..	..	5 1 10
200,000	Do. Do. 4½ % 1st Deb. Stk.	100	4½ %	4½ %	4½ %	4½ %	100 —103	100 —103	..	..	..	4 7 5
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	5 %	2 — 3	2 — 3	60/-	..	..	8 6 8
60,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	3 — 4	3 — 4	..	..	..	6 5 0
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	4½ %	4½ %	4½ %	95 — 98	95 — 98	96	95	..	4 11 10
110,000	Westminster Electric Supply, Ord.	5	13½ %	14 %	13 %	12 %	9 — 10	9 — 10	9½	9 7/8	..	6 0 0
81,279	Do do. 4½ % Cum. Pref. .. .. (Originally 5%—Red. to 4½ % from 31st Dec., 1905.	5	5 %	5 %	5 %	4½ %	5⅛ — 5⅜	5⅛ — 5⅜	5 3/32	..	..	3 18 3

Shares not officially quoted:—Mackay Companies, ord., 70—72 — 1½. Pref. 70—72 — 1½.

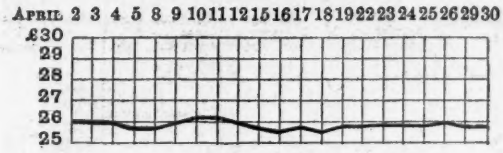
† Unless otherwise stated all shares are fully paid. ‡ Interim dividends

Bank rate of discount 4 per cent. April 25th. 1907.

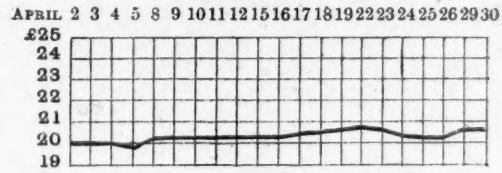
METAL MARKET.

Fluctuations in April, 1907.

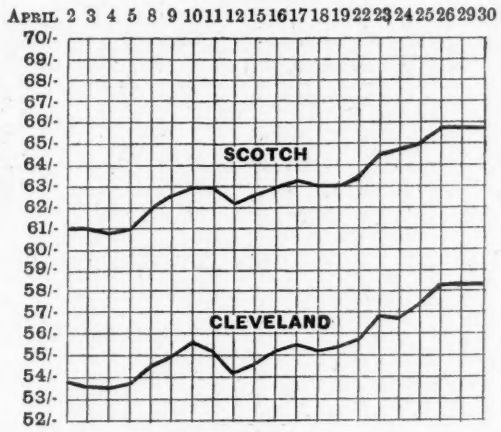
SPELTER (G.O.B's.)



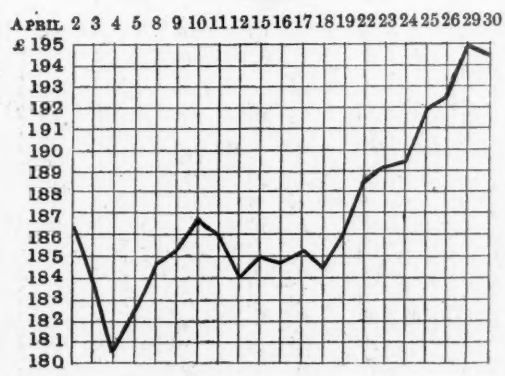
LEAD (ENGLISH)



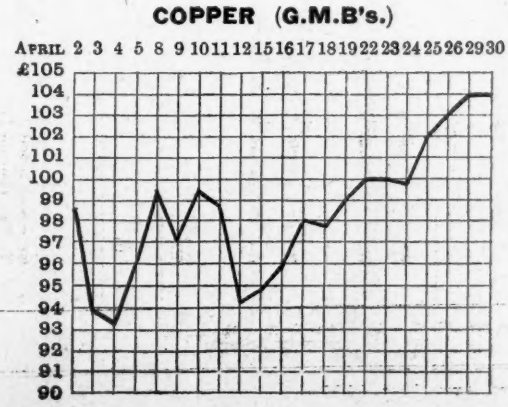
IRON.



TIN.



COPPER (G.M.B's.)



NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Canting Device for Lowering Centre-Pole Arc Lamps.

The London Electric Firm, of George Street, Croydon, have supplied us with particulars of their new patented canting carrier device, to enable centre-pole lamps to be lowered for trimming. Nearly all new street-lighting arc lamp installations are being carried out on the lowering principle, and a large number of existing ones are being changed to this system on account of the saving effected in trimming, and the greater safety from accidents as compared with the use of the tower ladder. Some Borough

Fig. 1.—Lamp in Position.

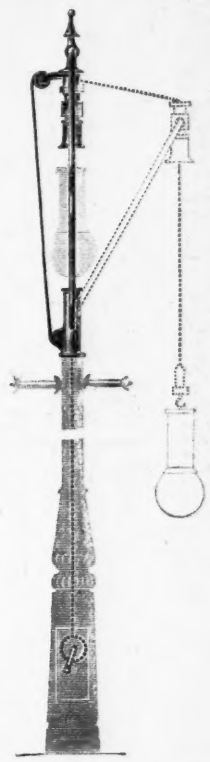


Fig. 2.—Lowering the Lamp.

Councils and companies, we learn, who have been mulcted in compensation for accidents, are changing on these latter grounds alone.

The last objection to the change, viz., the inability to adapt the centre-pole lamps to lowering, has now been removed by this patented adaptation of the well-known "one working part" arc lamp lowering gear. It consists of a canting carrier as shown in fig. 1 and fig. 2, which allows the lamp to be lowered; the whole operation of unlocking the carrier, lowering the lamp, rehoisting, relocking the carrier and taking the weight of the lamp off the rope, is done by a single winch. Existing carriers can in most cases be adapted, so as to attain the same end.

Ship Electric Stoves.

In consequence of the large business done by them in ship heating, Messrs. O. C. Hawkes, Ltd, of Aldersgate Street, E.C., and Birmingham, have now standardised a series of designs of electric

Fig. 3.—Electric Stove for use on Board Ship.

stoves specially adapted for the purpose. Their "XL" stoves are already quite well-known to our readers, both in regard to principle and artistic design, as is also their fine work in electric light fittings.

In the list that they have just issued relating to these ship electric stoves, it is shown that every requirement of the marine engineer has been catered for, and it is claimed that the stoves are of such a nature as to show no depreciation from vibration, saline atmosphere or rough usage, and that they contain no parts needing replacement, rendering it unnecessary to carry a store of spares to meet possible breakages. The stoves are very compact in design, and a well-made box can be supplied with each, in which the stove can be conveniently stowed in the hold, when not in use. For vessels passing through warm latitudes this is particularly useful. About a dozen different designs are shown in this list, with covers in antique hand-hammered copper and brass, polished brass satin finished and polished copper.

Some London Electric Fittings.

We have recently paid a visit to the new showrooms of the London Electrical Fittings Co., Ltd., at 15, Newman Street, Oxford Street, W. The firm have made considerable advance, not only in the nature of their designs, several representative examples of which we show, but also in the manner of their display. The firm, who are strictly a wholesale house, have only just removed from Soho Square, where they had one large room, which, though handsome, had the disadvantage of having to display various styles all together without any respect to each other, whereas in their new and artistic suite of rooms at Newman Street, the L.E.F. have one room set apart for the best English styles, a second for French and Adam periods, a third for Dutch and Jacobean, yet another for more general work, and so on. These rooms are all set out with panels in plain cloth background relieved with cream, forming a most effective surrounding to the fittings, and in excellent taste. We illustrate in fig. 4 a new arrangement for a 3-light rise and fall electrolier, distributing the balancing weight by means of three separate weights linked together at the top, through which the wires run, giving a very free and easy movement while lightening the effect of the whole. There was also on view a fitting in which the same idea was applied to a 2-light pendant in a Sheraton

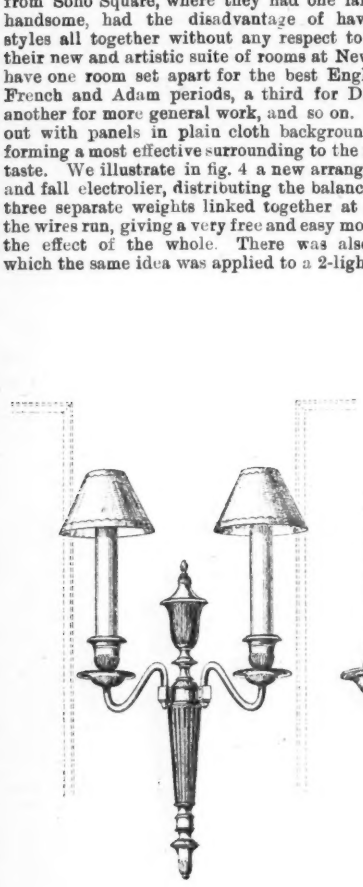


Fig. 5.

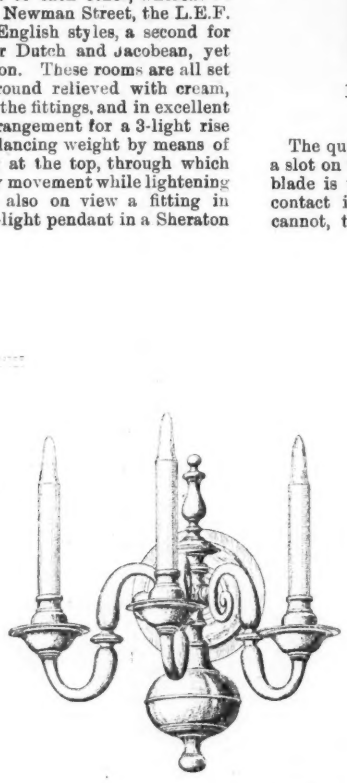


Fig. 6.

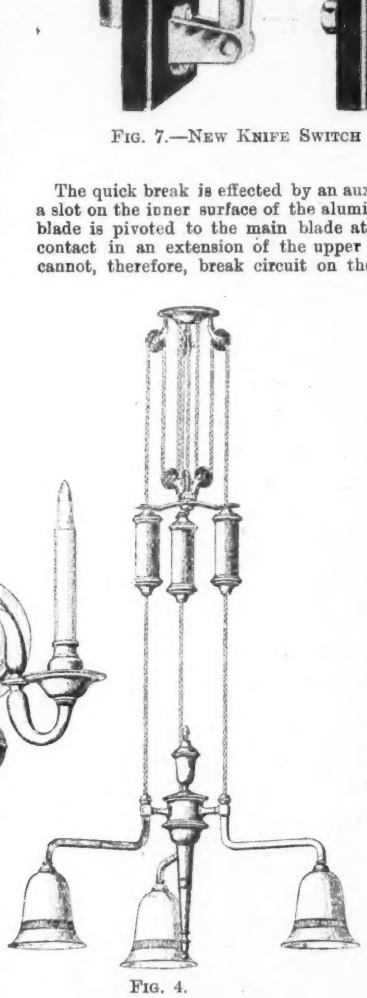


Fig. 4.

form, and our fancy was particularly taken by a very exquisite Adam floor standard, which was one of the company's new designs in this line, being of massive construction without taking up unnecessary floor space. Among other things seen was a 5-light chandelier on Sheraton lines, and in this connection we may illustrate the 2-light sconce which has been designed and made to match it. Fig. 6 is a heavy cast bracket in the Georgian style. The London Electrical Fittings Co. are making a display here also of their well-known "Wandsworth" switches and other accessories. We may add that the firm's new fittings catalogue, more than twice the size of the former one, will be published in the course of the next three or four weeks, and from a printer's advance copy that we have seen, we can say that it contains a comprehensive and tasteful selection for domestic purposes, and will be of service to architects and others who have the selection and purchase of high-class fittings for electric lighting.

Knife Switches and Fuses.

Messrs. Morris and Lister, of Coventry, are introducing a new standard line of switches and fuses. The switches are of novel design and embody a number of improvements in knife switch construction. The blade is of cast aluminium, equal in conducting power to the ordinary copper blade. Without increase in weight, the increased section gives a stiff blade and insures in every way a mechanically strong and rigid switch. The contact surfaces of the blade and the sides of its bearing are milled at one operation, so that the surfaces are perfectly true and parallel.

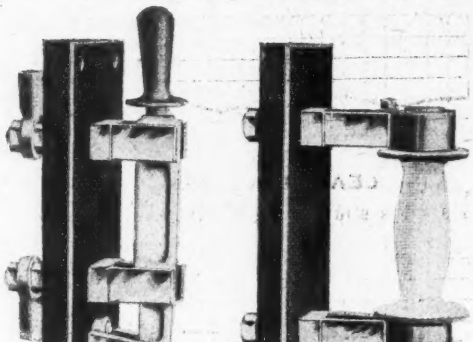


Fig. 7.—New Knife Switch and Switch-Fuse.

The quick break is effected by an auxiliary copper blade let into a slot on the inner surface of the aluminium blade. The auxiliary blade is pivoted to the main blade at its lower end, and makes contact in an extension of the upper copper stalk. The switch cannot, therefore, break circuit on the main contacts. The fact that the quick-break blade is hidden from sight, except when the switch is being operated, adds much to the neat appearance of the switch.

A novel feature of the design is the construction of the main contact clips. Each clip consists of two U-shaped pieces of hard copper strip, both ends of which are secured into the brass block in which the main copper stalk is screwed. The blade works between these copper clips; and, when it is pushed home, the clips do not curve outwards, but tend to move out parallel to the blade, thus ensuring contact over the whole of the contact-surface of the blade. The construction of the clips also admits of a larger pressure than usual being exerted on the contact surface.

The makers claim a much better contact than is usually obtained, and a correspondingly reduced heating and voltage-drop. We are informed that tests at twice the rated current on their switches and others of standard make show that, under normal working conditions as regards state of contact surfaces, the voltage-drop is less than one-half that occurring with contact clips of the well-known "M" pattern. In fact, their contact clip compares favourably with a brush contact. The clips spring inwards an ample distance to take up any wear which may occur.

The switch is constructed with a pivot entirely separate from the contacts, so that the blade is disconnected from the supply when in the off position. At the nominal capacity of the switch, the current densities in the current-carrying parts do not exceed 1,000 amperes per square inch in copper (even in the contact clips themselves, where the current density is frequently high) or its equivalent in the aluminium blade. The contact density is not greater than 60 amperes per square inch at the contacts as they are at present rated.

The same type of clip is employed by the makers for a line of switch fuses of the tubular porcelain handle pull-out type.

India.—According to *Indian Engineering* the manufacture of nitrate of lime as a fertiliser by means of electric power has been postponed, as the result of a report by the Agricultural Chemist.

PROCEEDINGS OF INSTITUTIONS.

Electric Wave Propagation.

By J. E. Taylor.

(*Paper read before the* Institution of Post Office Electrical Engineers (Metropolitan Centre), *January 11th*, 1907.)

(*Continued from page* 662.)

The Dynamics of Wave Motion in General.—It will, perhaps, serve to further clear the atmosphere if a brief statement of some of the elementary features of wave motion in general—that is, wave motion in any medium, material or etheric—be given. The analogies offered by comparisons of this kind are extremely useful and satisfying where they can be safely applied. The dynamics of wave motion have been largely considered and developed in connection with the theory of optics and the theory of sound, and to this end the highest mathematical processes have been usefully and powerfully applied by many able men.

Waves are waves all the world over, whether they be generated in air, water, or ether; whether they be material or etheric, and they conform to similar dynamical laws. Electric waves are merely the result of a disturbance of the ether, just as waves in water are a result of a disturbance of the water. In each case they are a translation of energy, and it is the method of generation only that differs. In order to enable us to get a grip of the ether to disturb it and so cause waves, it is necessary to call into operation electrical processes; no mass of matter be it vibrated as a whole ever so rapidly can disturb the ether, it is necessary to call into operation a connecting link between ether and matter, a connecting link which has been called the electron, by means of which we are enabled to get hold of some portion of the molecular electric field and adapt it to requirements.

A wave in water is a very good elementary analogy to an electric wave. It has its source in an oscillating centre such as may be produced by dropping a stone into it. The surface waves produced are of the transversal type, that is, they have transverse vibrations like electric waves. Longitudinal or compressional waves are produced at the same time, but these need not be considered. At the centre of propagation there is a true oscillation—a purely up and down motion of the water in which the energy alternates between the potential and kinetic types. Between this point and a circle of about a quarter wave-length radius the oscillation merges into wave motion, in which the difference of phase between the kinetic and potential energies is wiped out.* The result of the wiping out of this difference of phase is that when a wave passes a point in the water there is no tendency for that point to persist in oscillating. It simply moves in obedience to the wave impulse, and comes to rest the moment the wave has passed. Its motion is not of the pendulum type, but rather a circular or elliptical swing in which the energy of motion always exactly balances the energy of displacement or change of level. A similar effect is observed on throwing a pulse along a rope. After the pulse has passed a point in the rope, that part immediately comes to rest. It has no tendency to persist in oscillating. Regarding wave motion as propagated from point to point, this means that though such points propagate the wave forwards, there is complete absence of backwards propagation, or back-wave. This effect can be explained in a simple manner. (Fig. 17.) If the medium were

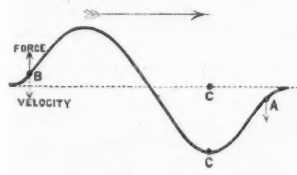


Fig. 17.

Fig. 18.

distorted into the shape shown, then suddenly released, it would oscillate and waves would be propagated both ways. On the other hand, if the distortion is due to the passage of a wave, there will be no backward propagation. The difference between the two cases is that in the first every point is acted on *while at rest*. In the second case, however, the wave acts on the front particles only from a position of rest, say particle A. At B the particle is acted on while moving with a velocity having a direction opposite to the force applied, and this just balances it, leaving it at rest.

In an electric wave the kinetic energy of the ether is represented by the magnetic field, and the potential energy by the electric field. These fields mean nothing else. They are only a convenient way of depicting the wave energy, and if it served any useful purpose the wave energy of a water wave or other wave in a material medium could be depicted in the same way.

The velocity of propagation of surface waves on water is not constant, but depends on the size of the wave, as gravity is the main controlling force. In a homogeneous medium, however, where the controlling forces are fixed and constant, the velocity of propagation is constant, and is determined by what are called the constants of the medium—the elasticity and the density. The controlling law is that the velocity equals the square root of the elasticity divided by the square root of the density, or—

$$v = \sqrt{\frac{e}{d}}.$$

In a homogeneous medium these are the only quantities which can control wave propagation. Hence, if the velocity of propagation be ascertained, we know the ratio which they bear to one another. This ratio is, in the case of the ether, enormously greater than for any material medium, and the fact constitutes one of the strongest arguments—if, indeed, any argument be required at this time—in support of the existence of the ether as distinct from matter.

Variation of Strength of Electric Waves with Distance from Source.—From the introduction of Hertzian wireless telegraphy in its early experimental stages, the most striking feature has always been the great range at which its effects can be obtained compared with the dimensions of the transmitter, a range which is many times greater than any previous electrical methods had achieved, and of which none of the many researches on Hertzian waves previously made had given indications. Some of the early Post Office experiments carried out in May, 1897, at Lavernock Point, near Cardiff, were therefore directed towards ascertaining to what extent the range of a transmitter consisting of an earthed vertical wire, about 15 ft. high, and interposed spark-gap, exceeded the range of a similar horizontal transmitter without earth connection arranged after the fashion of a linear Hertz radiator but with Righi spark-gap in oil. These experiments invariably indicated a range at least three or four times as great for the earthed vertical wire arrangement as for the horizontal arrangement with the same lengths of wire attached to either side of the spark-gap, even when the latter arrangement was elevated fully 10 ft. above the ground. In order to get the best results from horizontal transmitters and receivers, it is, of course, necessary that they should be at a considerable height from the reflecting surface of the ground. At this time the coherer was almost the only detector with which experiments of this kind could be carried out, and the results were necessarily only approximate. Since that time accurate quantitative instruments have been developed and better means of measurement rendered possible. Such measurements have fully verified the assumptions previously made, that the effects produced were greatly less attenuated by distance than any effects of induction or conduction.

In a comparatively recent series of Post Office experiments (Duddell and Taylor) carried out between H.M.T.S. *Monarch* and a shore station at Howth, near Dublin, accurate measurements have been made which have established the fact that the strength of the waves is inversely proportional to the distance beyond a certain critical distance, for a transmitter and receiver of the ordinary vertical wire type. Strength of electric waves, it should be noted, must not be confounded with energy. The strength of a wave is determined by the density of the electro-magnetic field. The density of the field is, therefore, inversely proportional to the distance. Comparing this with the field of the hypothetical isolated magnetic pole, or from a charged sphere insulated in space, where the density is inversely proportional to the square of the distance, or again with the field of a short magnet or that between two oppositely charged spheres close together where the density is inversely proportional to the cube of the distance from the centre of the system for distances large compared with the distance apart of the poles or spheres, the advantage conferred by wireless telegraphy for producing effects at a distance may be appreciated. From this relation between distance and density of wave, some information can be deduced as to the way in which the waves spread after leaving the transmitting wire if the assumption be made that there is no attenuation of the waves (*i.e.*, loss of density), except that due to the spreading of the wave shell over a larger area. That is to say, if it be assumed that there are no resistance losses due to the guidance of the waves over the conducting surface of the earth or sea. No serious objection need be taken to this assumption, so long as radial distances, which are large compared with the wave length, are concerned, as at such distances the earth or sea forms a conductor of very great and continually increasing effective circumference, and, therefore, of negligible resistance. A wave emission forming an expanding wave shell of constant thickness may be considered. The total energy of the shell will always remain the same, but the receiver will only make use of the energy in a small shell-segment of fixed size. As the wave density is inversely proportional to the distance, it follows that the energy per unit segment of the shell is inversely as the square of the distance; the energy of a magnetic or electrostatic field being proportional to the product of the number of lines and their density. This implies that the area of the shell is increasing in two dimensions. Its thickness being necessarily constant, it follows that it must be expanding vertically as well as horizontally. In other words, the height of the waves increases as they expand, at any rate for distances up to 60 miles, with wave lengths of the order of 700 or 800 ft., and with transmitters and receivers of the vertical wire type; these being the approximate data for the experiments carried out with the *Monarch*. It is not yet possible to say, however, what rate of increase of height is involved, that is, what slope of height, and this point will probably remain unsolved until the actual height at one point at least on the slope, can be measured. Meanwhile, with the reservation that the slope of

* The harmonic disturbance included within the quarter wave-length radius from the centre of the source may conveniently be considered as compounded of—(1) A true oscillation, in which every particle is swinging in unison between the two positions, but which is strongest at the centre and weakens to zero at its boundaries. (2) A true wave propagation in which the motion of each particle is passed on in a radial direction to neighbouring particles, but which is strongest at the boundaries and weakens to zero at the centre.

height assumed is arbitrary, the diagram of wave propagation shown in fig. 18 will sufficiently well represent the kind of result obtained in practical wireless telegraphy.

It has been argued, notably by M. Blondel, that the waves assume a completely spherical (or hemispherical) form after a certain number of wave-lengths distance from the source has been covered, and a diagram similar to fig. 19 has been given by him.

As this view of the matter is apt to be very misleading, a criticism appears necessary. It is opposed to the fundamental principles of electro-magnetic fields. No such spherical emission of

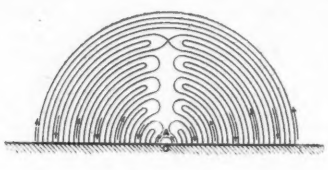


Fig. 19.

waves from any simple form of radiator has ever been observed. It is, perhaps, hardly necessary to point out that if this were a true explanation, it should also apply to the simple Hertz radiator. It is, however, a well-known and easily observed fact that the radiation effect from the ends or poles of such a radiator differs entirely from that along the equatorial axis of the system, and that this difference is more pronounced at greater distances, whilst, on the above supposition, similar effects should be observed all round at the greater distances. Moreover, it appears probable that spherical waves of the kind indicated are a physical impossibility. They would involve electrostatic lines crossing each other at the poles. In other words, the electrostatic forces at the poles would have an infinite number of resultant directions, and this is inconceivable, if not absurd. As an argument for this theory, it has been advanced that unless it occurs, Poynting's theory is not applicable so far as the "crests" (or more properly the "flanks") of the waves are concerned. An argument of this kind would involve a denial of the existence of rectilinear propagation and preclude the formation of shadows. Seeing that whenever a shadow is cast by an

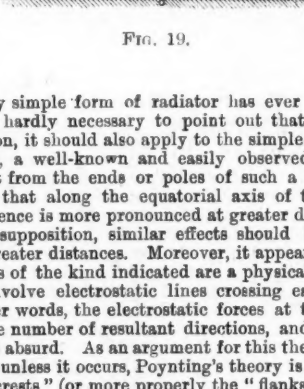


Fig. 20.

object which is interposed in the path of a wave train the waves are cut into two parts which *do not* again re-unite, it is fairly clear that if Poynting's theory is to be applied to this case in the same way, the theory must be extended. The facts remain.

Shadows Cast by Electric Waves.—The formation of shadows regarded as a re-arrangement of the electro-magnetic field forms an interesting study, and will no doubt, when fully developed, be capable of shedding considerable light not only on wireless telegraphy effects, but on optical theory. A self-explanatory diagram of the kind of re-arrangement involved is shown in fig. 20. It will be observed that the principle of fusion of the lines of strain again plays a prominent part. For the sake of simplicity the magnetic field is omitted from the diagram.

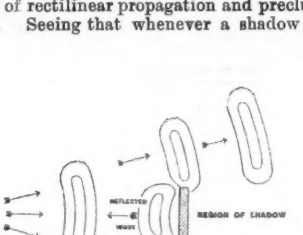


Fig. 21.

Possible Improvements by Limiting Vertical Spreading of Waves.—In connection with the question of rectilinear propagation, the possibility of determining a more nearly horizontal emission of waves from a wireless transmitter presents itself. If by any means the waves could be prevented from spreading upwards, and caused to assume a constant height, much greater efficiency of transmission would be assured. The vertical wire of a transmitter, together with the neighbouring earth surface, may be regarded as equivalent to a Hertzian oscillator with its two halves at right angles (fig. 21), so far as the emission from one side is concerned, as at A. The resultant direction of radiation from the enclosed part will have a pronounced upward tendency. By adopting the shape C, a less divergent propagation could be assured. At the same time the system becomes a less powerful radiator on account of its more enclosed field. If a somewhat similar principle be applied to wireless transmitters set up on the surface of the earth as shown at D (which represents the class of "umbrella" or "carpet" aerials), an improvement in this respect as compared with the simple vertical wire should be observed. On account, however, of the earth surface beneath having an area in excess of the "carpet" above, it will still have a pronounced tendency to emit upward-spreading waves. By elevating the whole system well above the earth's surface, as at E, the influence of that surface should become much less pronounced, and something approaching horizontal emission will probably be obtained. It remains to be seen, however, whether too much is not sacrificed in the way of radiative properties, but recent experiments made on these lines appear to indicate that more is gained than lost by adopting this arrangement. This plan of transmission involves the generation of free waves, which attach themselves to the earth's surface as they expand on leaving the radiator and then become guided waves.

(To be concluded.)

Depreciation.

By Robert Hammond, Member of Council.

(*Abstract of Paper read before the* Institution of Electrical Engineers, *April 25th*, 1907.)

In arriving at the net profits earned during any given period by an industrial undertaking, it is obvious that a determination should be made of the extent to which the assets of the undertaking have depreciated in value during that period. Where machinery and apparatus are employed it is necessary to estimate their probable "life," which, in the case of undertakings working on well-established lines, may be easily arrived at.

Having fixed a definite figure for the life, the sum which is equivalent to the annual depreciation of the machinery and apparatus may be written off annually and debited to the gross profits, this book entry involving no withdrawal of money from the undertaking; or out of the gross profits, annual investments may be made of such sums as will, at compound interest, reach the amount of the original cost of the machinery and apparatus by the time that they are worn out.

Turning to electricity supply undertakings one finds that their development has been so rapid, and the working conditions have so greatly altered in so short a time, that no standard method has yet been agreed upon for dealing with the question of depreciation, and no definite course has been pursued either by companies or by local authorities.

In the case of undertakings owned by local authorities the issue has, indeed, been somewhat obscured by the controversial questions which seem inseparable from all municipal undertakings, and by the difference between the financial basis of these undertakings and that of most other industrial concerns.

The object of the present paper is to invite the members of the Institution to consider the question of depreciation in all its bearings as applicable to electricity supply undertakings, in the hope that some definite conclusion may be arrived at as to the proper provision which should be made in the case of undertakings owned, whether by companies or by local authorities.

In the case of undertakings owned by companies, the consideration of these questions resolves itself merely into what should be the amount of the provision to be set aside annually from the gross profits in connection with the above items.

In the case of undertakings owned by local authorities, on the other hand, not only is it necessary to consider the amount to be provided under the three heads of depreciation, extraordinary emergencies, and antiquation, but a more controversial point arises—viz., the effect of the peculiar financial basis on which such undertakings rest, upon the necessity for these provisions.

Companies.

Whether the undertakings are owned by companies or by local authorities, the conditions governing their working are such that in order to give a continuous supply of electricity it is essential that machinery, apparatus, and mains should be kept in a high state of efficiency.

The cost of so maintaining the plant is, of course, regarded as part of the working costs, and is assumed to be so dealt with. Plant, well maintained as it may be, must, however, gradually depreciate, and a time will come when the frequency and extent of repairs and renewals necessitate so heavy an item of annual expenditure that it is preferable to replace it with entirely new plant.

On the basis that all plant would be carefully maintained and faulty parts renewed out of revenue, it is suggested that the periods named below represent a fair approximation of the life of the various classes of machinery and apparatus, &c., named:—

ESTIMATED YEARS OF LIFE.

	Years.
Land and buildings	60
Machinery and plant:—	
Boilers	20
Pumps and pipework	25
Conveyors	10
Engines	25
Turbines	20
Dynamos and alternators	25
Motors	20
Tools and sundries	10
Accumulators	15
Transformers, Static	15
Converters, Rotary	20
Switching apparatus and instruments	20
Meters	10
Mains { Armoured	25
Mains { Solid system	30
Mains { Ducts	30

If the above periods be accepted, it becomes a simple calculation as to the amount which must annually be written off or set aside to a sinking fund.

Reference has already been made to the alternative methods of dealing with the depreciation fund. Of those methods doubtless the sounder is that which provides for the annual investment, outside the undertaking, of such sums as will, accumulated at compound interest, represent from time to time the actual ageing of the machinery, apparatus, mains, &c.

It is true that if this method were adopted, each extension of the undertaking would necessitate the raising of fresh capital, which would have to be subscribed either by the existing shareholders or by the general public. Although this might cause inconvenience, yet, nevertheless, it is urged that by this method a far more definite control would be established over the growth of the undertaking, and the shareholders would have the option of either investing or refraining from investing further capital in it instead of being compelled to do so through the investment of the depreciation fund moneys in it.

It is also urged that should the course advocated be pursued, the company with such an asset at its back would be in a far more favourable position as regards the issue of fresh share capital than it would be if it had invested its depreciation fund in extensions, and was compelled to go to the public for more capital, at a time when a large proportion of its machinery and plant had become worn out.

The formation of such a fund, apart from the method of accountancy adopted, appears to be essential whether the company is working at a profit or a loss. In the event of its working at a loss for, let us suppose, the first few years, it seems only sound that before any moneys are distributed as dividends, not only should the trading losses be made good, but the contributions to the depreciation fund which otherwise would have been set aside should also be made.

However wise the formation of a general reserve fund might be for the purpose of equalisation of dividends, it nevertheless does not rank as a strict necessity as does a depreciation fund. Further, the author does not agree with those who hold that such a fund is necessary, not only for the equalisation of dividends, but for the purpose of providing against extraordinary expenditure due to unforeseen emergencies. Such risks should be fully insured against and the premiums regarded as part of the ordinary working costs.

Lastly, there is to be considered whether a fund to cover antiquation should be deemed obligatory.

It has been urged on the one hand that no provision whatever need be made under this heading. On the other hand, many hold the view that an antiquation fund is of vital importance.

The author does not share the latter view to the full extent, but he thinks that no electricity supply undertaking can be regarded as in a thoroughly sound position unless some provision has been made in the direction of an antiquation fund. At the same time this provision is, in his opinion, not one which would rank on the same footing as a depreciation fund *per se*, but is one which might wisely be contributed to out of profits as a sort of nest-egg for the future.

LOCAL AUTHORITIES.

In considering the case of local authorities owning electricity supply undertakings, it is seen that their method of raising the capital precludes them from adopting the plan in vogue among the companies of writing down the value of their machinery, apparatus, &c., and keeping the money in the business. The capital required is raised by means of loans upon the security of the general district rate, such loans having to be repaid at certain definite periods. These repayments are secured by the creation of sinking funds, the annual payments to the sinking funds being provided out of the revenue of the undertaking, and any deficit which may arise being met by a charge upon the rates.

In the case of loans authorised by the Local Government Board, the practice hitherto has been to allow a period of 25 years for the repayment of loans required for electricity supply undertakings.

This period is supposed to represent the average life of the various sets of machinery, apparatus, and of the mains, buildings, &c., upon which the capital expenditure is to be incurred. That is to say, that while the life of such items as lands, buildings, &c., is well over 25 years, on the other hand expenditure is incurred upon pieces of apparatus whose life is considerably less than 25 years.

In arriving at the true equated period of a number of loans, it is not sufficient to take the mean value of the lives of the assets, and thus to ignore the compound interest question. The exact method is to arrive by calculation at a period of years such that, if the total amount of the various loans were repayable at the end of that period, the present value of that loan would be equal to the present value of all the separate loans repaid at their various individual periods.

The difference between the results arrived at by these two methods is not great when the rate of interest at which the sinking fund is invested is about 3 per cent, and when the different periods are not greatly dissimilar. When, however, the periods to be equated differ widely, or when the rate of interest is a higher one, considerable difference appears.

It has often been contended that in the case of local authorities no further provision for depreciation beyond the sinking fund payments is necessary in arriving at the true annual profits, owing to the fact that the annual contributions to sinking fund are such that by the time the plant has been worn out, the indebtedness in respect of the capital expenditure on the same will have been extinguished.

The opponents of municipal trading have not only strongly contested this view, but the discussion has been further complicated by attacks on the period of 25 years, arrived at by the equation of the lives of the various portions of the plant.

Apart, however, from the soundness of the basis taken in arriving at the equated period for repayment of loans, the opponents of municipal trading have contended that not only should annual contributions to the sinking funds be made of such amounts as will be sufficient to extinguish the indebtedness at the end of the loan periods, but that further contributions should be made either from revenue or from the rate fund of such amounts as would provide a fund sufficient entirely to renew the machinery, apparatus, mains, &c, without incurring fresh indebtedness when the original "outfit" is worn out. That is to say, it is sought to burden the undertakings of local authorities not only with the instalments by which their indebtedness is extinguished, but with further contributions in the form of "provision for depreciation" equal in amount to what would be set aside for that purpose in the case of undertakings belonging to companies, in spite of the fact that in the latter case no provision for the repayment of the original capital is made.

The principle hardly seems sound.

Assuming for the moment that the equated period in the case of the loans for electricity supply purposes were exactly correct, and that it truly represented the life of the plant, the undertaking at the end of the equated period would be free from debt by the operation of the sinking fund, and would be then in just as good a position from the ratepayers' point of view as it was when the undertaking was first begun.

The question may be asked: Why is it necessary to consider undertakings owned by local authorities on a different basis from those owned by companies? If the sinking fund payments be regarded as part of the contributions to the depreciation and reserve funds, the two classes of undertaking might surely be considered together.

The question, however, does not present so simple an issue as this, since, in the case of local authorities, the period for the repayment of loans is an equated one, and does not actually represent the period of time during which the whole of the "plant" used in the undertaking will continue in proper working order, though efficiently maintained. Certain portions of the plant have shorter lives than others, and when they are worn out it is necessary to incur further capital expenditure in order to replace them. As, however, the sinking fund remains intact until the end of the equated period of 25 years, no portion of it is available for the renewal of the short-lived portions of the plant when they are worn out.

We have carefully to consider what effect these circumstances have on the building up of the depreciation fund; should it make provision for the renewals of the short-lived portions of the plant in order to avoid the necessity for incurring fresh indebtedness before the original loans had been repaid?

If any particular portion of the plant had only a life of ten years, and was provided for by a ten years' loan, it is obvious that at the expiry of the ten years, and the wiping off of the original loan, an amount could be re-borrowed to provide the new plant. The tendency of the Local Government Board is to divide up the loans into periods of life, and when this is done universally all will be plain sailing. In the meantime, the difficulty arises in the case of all loans for equated periods.

It must be remembered that the annual contribution to the sinking fund in the case of equated loans covers the depreciated life of both short and long-lived assets, and, in my opinion, a local authority should be permitted to re-borrow for the replacement of worn-out machinery, apparatus, &c., provided that such re-borrowings shall from time to time never exceed the amount contributed to the sinking fund, and provided that the term of the new loan should coincide with the "life" of the new plant. If this were permitted a local authority would be placed in the same position as a company in respect of its depreciation fund.

The author's final contention, then, is that a local authority should treat depreciation exactly as a company treats it.

It should set aside annually such sums as, properly invested, will enable it to wipe off the value of the machinery and plant at the end of its life. If the loan in respect of such machinery and plant is for a period similar to that of their life, then no further sum need be set aside annually.

If, however, the loan, as in the case of some local authorities in the metropolis, be for a period of 42 years, whereas the equated life of the plant was agreed to be 25 years, then the annual instalments should be of such amount as would produce the capital sum in 25 years. The actual contributions to the 42-year sinking fund

would be treated as part payments, and it would be necessary to set aside a further sum annually to bring the contributions up to a 25 years' basis.

To carry this illustration further, it may be noted that to liquidate a loan of, say, £100,000 in 25 years requires an annual instalment of £2,742 16s. (presuming an investment of 3 per cent.), whereas only £1,219 4s. would be required if the loan were spread over 42 years.

Residual Values.—As a depreciation fund must in its nature be based upon an estimate, it has seemed to the author wise to regard the residual value as an item which the undertaking would have to the good at the end of the respective lives, and one which to that extent would be in hand as a contribution towards the cost of new plant.

Discussion.

The discussion was opened by Alderman Ewing Matheson (Leeds), who differed with the author as to the form which provision for depreciation should take. He contended that renewals [Presumably on a generous scale.—Eds. E.R.] and depreciation were one and the same thing; the adequate renewal of plant was equivalent to the investment of the depreciation fund in the business, where it would earn 6 or 7 per cent., as compared with only 3 per cent. if invested in the ordinary way. From experience he judged that plant might become obsolete at almost any time, *i.e.*, that it might be policy to scrap comparatively new plant, and he concluded by advising his hearers to "collar" all the money they could for creating a strong reserve fund.

Mr. A. A. C. Swinton drew a distinction between the ordinary company shareholder and the sometimes unwilling municipal shareholder, who had not the same amount of control of his undertaking's finances. He believed that, in the case of a lighting company, which could be acquired after a term of years by a local authority, the question of providing depreciation or not was a serious matter, as there seemed to be a chance of the company having to part with its fund on the one hand, or of its obtaining little extra benefit if that fund were invested in the upkeep of plant. For small undertakings, all renewals should be met out of revenue.

Mr. Shirley Price urged that it was wrong to include sinking fund in depreciation. It was difficult to estimate the life of plant accurately, but he thought the author's estimate much exceeded probabilities. Antiquation, or obsolescence, was a serious factor. The only practical way to estimate depreciation was to employ an outside expert, who would re-examine the plant year by year for a small fee; neither an accountant nor an engineer could be depended on to fix reliable rates of depreciation.

Mr. W. R. Cooper agreed, on the whole, with the author's life estimates; these figures depended on the character of the load to some extent. The difficulty was the replacement of the short-lived assets, due principally to the L.G.B., and apparently the only way to get over this was to suggest a course of action to that authority, and to do something else at a convenient opportunity. He thought the Council of the I.E.E. might very well deal with the matter.

Other speakers referred to the question of battery maintenance payments, which, it was argued, should be regarded as depreciation payments—the battery being as good as new at the end of the maintenance period; also to the question of residual values, which might be taken account of before reckoning the depreciation repayments, and which would vary considerably, say, in the case of drawn-in and solid laid cables.

Mr. Robt. Hammond briefly replied. He pointed out the divergence of opinion between those who looked for residual values and those who reckoned on obsolescence in six or eight years, although he could not agree with the last estimate in the interests of the consumer. It was an important matter as to whether purchasable companies should set aside depreciation—he could scarcely conceive that a depreciation fund could be confiscated under any ordinary circumstances, when an undertaking was bought up as a going concern.

ANOTHER NEW APPRENTICESHIP SYSTEM.

By F. B.

The apprenticeship question is one of those fascinating subjects which, like perpetual motion, has been solved over and over again, on paper, but which in practice seems to evade satisfactory solution.

Perhaps it is that there are many solutions, each equally correct when viewed from the particular standpoint of its author, but that no one solution is capable of being generally applied to suit all cases.

A considerable mass of evidence was given on the subject before the Royal Commission on Labour in 1892, and even for years before that the subject was exercising the minds both of Trade Union officials and employers.

The Trade Unions at that time, with a view to keeping all their members employed, and also to making the employers dependent upon the Unions, sought to restrict the number of apprentices employed to one-fifth of the number of journeymen. The effect of this, in the event of a strike, would be to leave, at most, only 20 apprentices in a Union shop for every 100 men on strike. Under such conditions the works would be brought practically to a standstill.

This may, or may not, have been the intention of the Unions, but at any rate they desired such a limitation of apprentices, the Boilermakers and Iron Shipbuilders' Society having a definite rule to this effect.

Mr. Inglis, of Glasgow, in giving evidence before the Commission above referred to, pointed out, supporting his argument by statistics, that unless a journeyman's working life were five times that of his apprenticeship, viz., 25 years, and unless there were no loss of lads during apprenticeship, each industry so restricted would be doomed to extinction.

The policy of some Trade Unions has not only had the effect in the past of stifling the trades they purported to represent, but, failing to profit by experience, prevents their being revived. The account given recently by Mr. Hirst, at the Robertson Lamp Works, of his attempts to revive the glass-blowing industry, and the discouragement he met with at the hands of the Glass-Blowers' Union, whose action has practically killed the trade in this country, forms a striking commentary on the deplorable work of such Unions.

But for the powerful combination of engineering employers, the British engineering trades would have probably followed the glass trade as a result of the machinations of the A.S.E. and allied Societies. Fortunately, however, the Employers' Federation, formed at a very critical period in the history of engineering, was able to exert a timely and salutary influence on the policy of the officers of the Engineers' Union; an influence which has left its permanent impress on the Society, and for which not only the members of the A.S.E., but the country at large, whose prosperity is so largely bound up with its engineering activity, owe a deep debt of gratitude.

Sufficient time has not elapsed since the formation of the Engineering Employers' Federation for its work to be fully appreciated, but when in succeeding generations current events are viewed in their true perspective, its beneficial influence on the industry of the country will stand out in bold relief against the dark background of self-seeking, short-sighted Trade Unionism.

In the meantime, however, the Unions have gradually, though reluctantly, been forced to appreciate the changed conditions of skilled labour, and to recognise the futility of kicking against the unyielding goads of progress, which has brought with it the inevitable results of a wider knowledge of applied science and technology in their relation to machine shop practice, including the ever-increasing use of labour-saving machinery with its standardisation of parts, and its stereotyping of the work of the artisan.

Since the memorable settlement at the Westminster Palace Hotel in 1898, we have had 9 years of comparative peace in the engineering trades, but there is a tendency in some quarters to reopen the old questions. In a recent article in the *Manchester Evening News*, Mr. F. H. Rose, A.S.E., one of the delegates who sat at the 1897 Conference, considers that the 10 years' working under the agreed conditions only proves that the terms of the settlement have fully deserved the designation of "The Employers' Charter," and that the time has now come when the A.S.E. is in a sufficiently commanding position to force a modification of the terms.

It would, perhaps, be wiser for so powerful a union to devote its energies to evolving some acceptable form of apprenticeship suited to modern conditions, and to endow scholarships at technical colleges, open to the sons of its members, rather than leave it to employers always to take the initiative in matters concerning the welfare of apprentices.

It is becoming generally recognised that the old-fashioned system of apprenticeship, as applied to modern workshop conditions is, as pointed out by Mr. Napier in 1897, a barbarous system.

When a workshop was, in its literal sense, a manufactory, when the various parts of a machine or engine were hand-turned, hand-filed, hand-drilled and tapped, and when, in fact, every operation was manually performed, a five years' apprenticeship was probably not too long for the incubation of a skilled mechanic.

Whilst learning to file and chip flat, to drill and tap on the square, and the many other operations required of the old-fashioned fitter, an apprentice spoilt a lot of good stuff and wasted a great deal of time during his first year or two. For this privilege he had to work during the remainder of his time for, perhaps, a little less than he was actually worth.

But what are the conditions now? A youth of average ability can learn all there is to know about a machine tool in, say, a month, and earn as much on it, judged by "the piece," as a fifth-year apprentice. In a year he can probably work any ordinary machine tool in the place.

Another 12 months in the erecting or assembling shop would suffice for him to learn all that the shop could teach him as regards the handling of tools. Why, then, should he wait for another three years before being paid at his market value? He would not be worth as much as an experienced man who had handled all kinds of erection and repair work; but as a machine minder, or assembler, he would be fully fledged.

Nor would such a two-year apprentice be so valuable as one who had undergone either beforehand, or concurrently, a techical training, and he ought not, therefore, to be able to command the same remuneration.

It is for this reason that many engineering firms now discriminate between the ordinary apprentice and the apprentice-graduate, giving advantage to the latter, either in increased remuneration or in a reduction in the term of apprenticeship, or both. One of the most complete schemes of this nature is that formulated by the North-East Coast Institute of Engineers and Shipbuilders, and adopted by many of the leading engineering firms on the N.E. coast. This system has already been described in our columns, and we hope in due course to be able to record the practical result of its operation.

The latest attempt to solve the apprenticeship question is that of Messrs. Clayton & Shuttleworth, who have attempted to "graft the advantages of the bygone system upon the so-called factory system of modern times." The "bygone system" was that in which master and apprentice came into close personal contact with one another; a system in which the master was as ready to teach his trade as the apprentice was to learn it. It is no easy task to embody these features in a system dealing with present-day machine shop practice, in which an apprentice does not learn a trade but simply practices one or more stereotyped operations, and the more skilful he becomes at certain routine work, the greater is the tendency for his foreman to keep him at it.

Messrs. Clayton & Shuttleworth, recognising that the old term of seven years' apprenticeship is not now necessary, but that a shorter term, coupled with technical instruction bearing upon the various branches of the trade, provides a training more in harmony with present-day conditions, have devised a course of apprenticeship in which these two factors are combined. No premium will be accepted from any apprentice, and the firm will maintain its own school in the works, where books and apparatus will be provided free of charge. A superintendent will be appointed, whose time will be given up entirely to the supervision, teaching, advising and promotion of the apprentices.

The works of Messrs. Clayton & Shuttleworth comprise many trades, including general machining and turning; fitting and erecting; tool making; pattern making; joinery; wheelwrighting and wood working; moulding; smith's work and boiler making.

Under the proposed system the youth would be apprenticed to one of these trades, and, generally speaking, would not be transferred to any other; but, as far as possible, he would be given opportunities of devoting a certain portion of his time and work to allied trades. If an apprentice shows marked or natural ability for undertaking responsible positions, opportunities will be given him to become acquainted with the higher branches, such as works management and administration.

All apprentices are expected to attend the works school, and for those who enter at the age of 18 and upwards, a three years' apprenticeship only is required, the rate of pay being 8s. first year, 10s. second year, and 12s. third year, per week of 54 hours. This applies to all except moulders, smiths and boilermakers, who entering at the age of 18, require to serve four years, and receive higher rates of pay, ranging from 10s. to 18s. per week in the fourth year.

The rates do not appear to be particularly tempting, but it has to be borne in mind that no premium is taken, and the apprenticeship includes technical tuition. It will be interesting to see how the scheme works out in practice.

The idea of each works having its own trade school is one which has much to commend it, if the tuition is such as bears specially upon the details of the trade to which a youth is apprenticed. On the other hand, the multiplication of works schools would mean that such schools would not be able to command the services of such teaching specialists as are engaged by the public technical institutions, and there would appear still to be a need for these as preparatory schools, from which such special trade teaching as can more effectively be given in works schools might with advantage be excluded.

NEW PATENTS APPLIED FOR, 1907.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

13,494A/06. "Improvements relating to electric furnaces." S. Z. de Ferranti. (Date applied for under Rule 5 of the Patents Rules, 1905, June 18th, 1906.) April 18th.

19,461A/06. "Improvements relating to systems of electrical distribution which vapour electric devices are employed." P. H. Thomas. (Date applied for under Patents Act, 1901, September 1st, 1905, being date of application in United States. An invention comprised in application No. 19,461, dated August 31st, 1906.) April 20th. (Complete.)

8,670. "Improvements in electric batteries." J. T. Szek. April 15th.

8,677. "Improved holder or support for telephone receivers." W. Farrants. April 15th.

8,706. "Improvements in or relating to commutators for electric circuits." C. Schmidt. April 15th. (Complete.)

8,727. "Improved method of telegraphically transmitting photographs and the like, and system therefor." A. Korn. April 15th. (Complete.)

8,742. "Improvements in electrical controllers or switches." C. T. J. Oppermann. April 15th.

8,761. "Arrangement of the filament of a high-voltage electric lamp of small energy consumption." C. Glogau. April 15th. (Complete.)

8,762. "Improvements in or appertaining to trolley wheels or collectors for electric traction." A. E. Duguid. April 15th.

8,764. "Improvements in controlling devices for electric motors." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 15th.

8,765. "Improvements in methods of and apparatus for measuring electricity." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 15th.

8,838. "Improvements in electro-mechanical toys." H. Ruhl. April 16th.

8,841. "Improvements in incandescence bodies suitable for lighting and heating purposes." Allgemeine Elektricitats-Ges. (Date applied for under Patents Act, 1901, April 17th, 1906, being date of application in Germany.) April 16th. (Complete.)

8,842. "Improvements in and relating to electric motor-controllers." E. Schattner. April 16th.

8,846. "Improvements in controlling systems for electric railways." W. Arthur. April 16th.

8,850. "Improvements in electricity meters." G. C. Fricker and W. M. Mordey. April 16th.

8,851. "Improvements in or relating to multiphase electric induction motors." H. A. Mavor and Mavor & Coulson, Ltd. April 16th.

8,860. "Improvements in driving-wheels for electrically-propelled vehicles." D. Balachowsky and P. Caire. (Date applied for under Patents Act, 1901, May 15th, 1906, being date of application in France.) April 16th. (Complete.)

8,865. "Improved mode of, and means for, working electric lamp signs." H. W. Pink. April 16th.

8,874. "Alternating-current vapour apparatus." K. Hahn. April 17th.

8,881. "Improvements in intercommunication telephone systems." I. H. Parsons. April 17th.

8,903. "Improved electric lamp." J. Davis. April 17th.

8,913. "Improvements in electric switches or circuit-breakers." E. T. Bumpstead and H. C. Gover. April 17th.

8,948. "Improvements in electric motor-controlling devices." Allgemeine Elektricitats-Gesellschaft. (Date applied for under Patents Act, 1901, April 17th, 1906, being date of application in Germany.) April 18th. (Complete.)

8,951. "Improvements in distribution of electricity." W. J. Davey. April 17th.

8,953. "Improvements in or connected with brake mechanism for electric winding appliances." P. H. Dawe. April 18th.

8,954. "Improvements in electric winding appliances and in the methods of operating the same." P. H. Dawe. April 18th.

8,984. "Improved electricity meter." G. Hookham and S. H. Holden. April 18th.

8,999. "Improvements in machines or apparatus for reproducing in ordinary characters, telegraphic or other messages or intelligence in the form of perforations in a tape." F. G. Creed and W. A. Coulson. April 18th.

9,009. "Improvements in telautographs." F. Ritchie. April 18th. (Complete.)

9,010. "Improvements in telautographs." F. Ritchie. April 18th.

9,017. "Reflectors for electric and other lamps." H. Tartsch. (Date applied for under Patents Act, 1901, April 20th, 1906, being date of application in Belgium.) April 18th. (Complete.)

9,028. "Improvements relating to the oscillatory circuits of radio-telegraph systems." The Amalgamated Radio-Telegraph Co., Ltd. (H. Rosenthal, Germany.) April 18th. (Complete.)

9,029. "Improvements in electrolytic apparatus." P. Borgnet. April 18th. (Complete.)

9,033. "Improvements in or relating to controlling or actuating mechanism and tape feeding mechanism suitable for use in machines or apparatus for reproducing in ordinary characters, telegraphic or other messages or intelligence in the form of perforations in a tape." F. G. Creed and W. A. Coulson. April 18th.

9,051. "Improvements relating to the oscillatory circuits of radio-telegraph systems." The Amalgamated Radio-Telegraph Co., Ltd. (H. Rosenthal, Germany.) April 18th. (Complete.)

9,055. "Improvements in and relating to electro-magnetic driving and switching mechanism." British Thomson-Houston Co., Ltd. (Allgemeine Elektricitats-Ges., Germany.) April 18th.

9,066. "Improvements in trolley rope holders for electric cars." F. Day and C. H. Marsland. April 19th.

9,143. "Improvements in electricity meters." Isaria-Zahler-Werke G.m.b.H. (Date applied for under Patents Act, 1901, April 27th, 1906, being date of application in Germany.) April 19th. (Complete.)

9,157. "Improvements in controlling devices for electrical machines." D. Balachowsky and P. Caire. April 19th. (Complete.)

9,172. "Improvements in electric arc lamps." E. R. Ingram and H. Hunt. April 19th.

9,176. "Improved safety cable." Land und See-kabelwerke Akt.-Ges. (Date applied for under Patents Act, 1901, August 3rd, 1906, being date of application in Germany.) April 19th. (Complete.)

9,198. "Improvements in electrical curative appliances." G. R. Peers. April 20th.

9,234. "Improvements in and relating to electric measuring instruments." British Thomson-Houston Co., Ltd., and F. Holden. April 20th.

9,235. "Improvements in machines for use in the manufacture of incandescent electric lamps." British Thomson-Houston Co., Ltd. (General Electric Co., United States.) April 20th.

9,240. "Improvements in electric timepieces." M. Moller. April 20th. (Complete.)

EXPIRING PATENTS.

(Continued from page 704.)

20,793. "Siphon Recorder." A. Muirhead, of Westminster. November 2nd, 1893. Relates to a siphon recorder of the kind described in Specification No. 3,413, A.D. 1893, which is provided with arrangements for adjusting and removing the cradle suspension piece, &c. One form of the apparatus consists of poles of a laminated magnet and a support provided with a rack adjustment and carrying an iron core situated inside the pivoted or suspended rectangular coil. To the support an arm is attached, which carries a bridge-piece. The aluminium frame or cradle for the siphon is stretched across the bridge-piece, and is vibrated by a make-and-break magnet and armature. The ink-box is carried by an adjustable support, and a paper roll is driven by means of band gearing from a driving motor.

20,816. "Electric Couplings." H. R. Keithley, of Chicago, U.S.A. November 2nd, 1893. Relates to couplings specially adapted for rails used as conductors in electric railway systems. A rod is provided with tubular or thimble-shaped terminals, which are fitted in holes in the webs of the rails and permanently expanded by means of pins or plugs. Notches facilitate the entrance of the plug.

21,379. "Photography." A. G. Adamson, of Glasgow. November 10th, 1893. Relates to an arrangement of incandescent lamps for use in photographic studios. To prevent shock to the eyes of persons being photographed, the light is turned up gradually by means of a resistance switch. A chamber in which the lamps are fixed is suspended on pivots from a bow, which is hung from the end of a beam attached to a carriage and counterbalanced by a weight. The carriage runs on rails. The dome-shaped chamber containing the lamps can thus be adjusted to any required angle or position.

21,496. "Railway Points and Signals." I. A. Timmis, of London. November 11th, 1893. The objects of the invention are: By electrical means (1) to work the points, the safety locking bar, and the point-locking bolt; (2) to operate the semaphores, to interlock the signals with the points, and by the use of selector bars to make the movement of the points select the proper signal; (3) to enable the trains to restore the signals to "danger" as they are being passed; (4) to light a red or a green signal-lamp according as the semaphore arm is at "danger" or "clear"; (5) to repeat the movements of the points, point-lock, and signals in the cabin; (6) to indicate visibly and audibly the position of the line signals on the locomotives; (7) to work the signals automatically, if desired, in conjunction with any or all of the above arrangements. The signal levers are mechanically interlocked by means of tappets, and are arranged to make and break electric circuits of a battery. The semaphores, the points and point-locking, etc., apparatus are respectively operated by electro-magnets. The stretcher bar is divided so that the correct working of the points will be detected by a locking-bolt. Selector bars are connected to the stretcher bar, and another bar is connected to the locking-bolt so as to make and break a portion of the circuits. In order to economise the electrical energy, the circuit of the point-operating magnet is broken when the locking-bolt is locked, a resistance is switched into the circuit that locks the locking-bolt and the circuit of the locking-bolt operating magnet is broken when the locking-bolt is locked by means of an electro-magnet. By using selector bars to complete different circuits according to the position of the points, two semaphores are operated by a single lever. The specification describes a system for automatically operating the signals by means of the passing train operating levers or other contacts controlling a local relay circuit, and the arrangement is such that a signal cannot be lowered until the circuit is partly completed by the signals in the rear moving to danger, and thereby operating electric contacts on their arms. When a signal has been lowered it is held by a reduced current so as to economise electrical energy. In order to indicate the positions of the signals on the trains, or the positions of other apparatus to the signalman, needle indicators arranged to be deflected in opposite directions by corresponding currents are used. When used on the train the indicator is connected to earth through the wheels and to a brush running on a conductor connected to a battery through a reversing switch on the adjacent semaphore arm.

21,707. "Ozone: Electric Lamps, Incandescent." E. Andreoli, of Surrey. November 14th, 1893. Relates to apparatus for obtaining ozone by means of the silent discharge of electricity from points, angles, and the like. Consists in employing somewhat similar arrangements for producing both ozone and light. Any exhausted receiver, as a tube or incandescent lamp bulb, is provided internally with a carbon filament, or with one or more metallic wires or rods connected to one pole of a Ruhmkorff coil or a high-frequency transformer. Outside the receiver are arranged, in any manner, serrated wires or the like, having the points directed inwardly, and connected to the other pole. On passing the current, the interior of the receiver becomes luminous, there is a glow on each of the external points, and ozone is generated.

(To be continued.)

PUBLISHED SPECIFICATIONS.

Copies of any of these Specifications may be obtained of Messrs. W. P. Thompson & Co., 322, High Holborn, W.C., and at Liverpool, price, post free, 9d. (in stamps).

1905.

Means for Converting Varying Alternating Electric Current into Similarly Varying Direct Current. S. G. Brown. 26,688. December 21st.

Motor Systems with Electric Transmission for the Propulsion of Railway, Tramway, Road or Similar Vehicles, Boats and the like. E. W. Hart and W. P. Durtnall. 27,696. December 28th.

1906.

Ignition Devices for Internal Combustion Engines and the like. S. Brotherhood and C. W. Bryant. 20,980. September 21st. (Secret document under Section 44, Patents, &c., Act, 1883.)

Trolley Wheels for Electric Tramways or Railways. F. E. Kenny. 22,101. October 6th.

Box or Covering for Lead-Cased Electric Cables. J. Stratton and E. A. Claremont. 24,682. November 2rd.

Clinchers for Electric Trolley Wire Ears. E. O. Marsh. 26,198. November 19th.

Attachment to Telephone Receivers for Protecting the Ear. A. Mosbach. 26,760. November 24th.

Operation of Vapour-Electric Lamps. M. Fuss. 29,202. December 21st. (Date applied for under International Convention, January 11th. 1906.)

Electrodes for Arc Lamps. Gebrüder Siemens & Co. 29,416. December 24th. (Date applied for under International Convention, May 17th, 1906.)

Electrical Automatic Bolt. E. E. Daniel. 5,599. March 8th (post-dated, September 8th, 1906).

Dynamo-Electric Machines. L. J. Hunt & the Sandycroft Foundry Co., Ltd. 6,223. March 14th.

Alternating Current Dynamo-Electric Machines. L. J. Hunt and the Sandycroft Foundry Co. 6,224. March 14th.

Electric Furnaces. P. R. Kuehnrich. 6,283. March 15th.

Apparatus for Measuring and Recording the Flow of Liquids or Gases, and for Measuring and Recording Mechanical and Electrical Quantities. J. E. Lea. 6,454. March 17th.

Apparatus for Winding Wire and the like, Especially Applicable for Use in the Manufacture of Electrical Machinery. H. L. Hollington. 6,477. March 17th.

Portable Device for Use in Connection with means for the Ignition of Explosive and Ignition Caps and the like. W. Venier. 6,705c. March 20th. (Date applied for under Rule 5, Patents Rules, 1905, March 20th, 1906.)

Electric Glow Lamps. P. M. Justice (Deutsche Gasglühlicht Akt.-Ges. Auergesellschaft). 6,803. March 21st.

Apparatus for Generating Electricity. J. de Törley & E. Benkö. 6,820. March 21st.

Mercury Vapour Apparatus and the like. C. O. Bastian and G. Calvert. 6,833. March 21st.

Electric Switch Apparatus. A. F. Berry. 7,162. March 24th.

Manufacture of Incandescence Bodies of Refractory Metals for Electric Lamps. A. G. Bloxam (J. Lux, Austria). 7,188. March 24th.

Electrical Connector for Electric Lamps and other Apparatus. W. L. Wise (C. H. Tischner). 7,293. March 26th.

Method of and Means for Signalling or Effecting Operations in Local Electric Circuits by means of Sound or other Vibrations. H. Gardner. 7,565. March 29th.

Magnetic Ignition Apparatus for Internal Combustion Engines. Electric Ignition Co. and F. H. Hall. 7,836a. April 2nd. (Date applied for under Rule 5, Patents Rules, 1905, April 2nd, 1905.)

Systems of Control for Electric Motors. British Thomson-Houston Co. (General Electric Co.) 8,680. April 10th.

Signalling Apparatus for Railways and the like. British Thomson-Houston Co. (General Electric Co.) 9,416. April 21st.

Machines for Making Stems for Incandescent Electric Lamps. British Thomson-Houston Co. (General Electric Co.) 10,021. April 30th.

Clockwork-Driven Commutator Switch for Operating Audible and other Signals. G. Ulmann. 11,317. May 15th.

Arc Lamps. H. E. Moul. 11,594. May 18th.

Automatic Controlling Devices for Electric Circuits. British Thomson-Houston Co. (General Electric Co.) 11,659. May 18th.

Shaft Bearings, Especially Applicable to Electric Railway Motors. British Thomson-Houston Co. (General Electric Co.) 12,820. June 16th.

Receivers for Wireless Telegraphy. P. O. Pedersen. 14,792. June 28th (date applied for under International Convention, July 4th, 1905).

Apparatus for the Automatic Distribution of the Operating Service in Telephone Exchanges. Kjöbenhavns Telefon-Aktieselskab. 14,851. June 30th (date applied for under International Convention, June 30th, 1905).

Means for Obtaining Thin Liquid Dross in Electric Furnaces for Metallurgical Purposes. H. Röchling and W. Rodenhauser. 17,615. August 4th.

Apparatus for Adjusting the Height of Electric Lamps. Carl Borg Fabrik für Elekt. Installations material Ges. 17,886. August 9th.

Method of Producing Indestructible Filaments for Lighting and Heating Installations. G. Michaud and E. Delasson. 18,643. August 20th (date applied for under International Convention, September 30th, 1905).

Fuses for Electrical Circuits. G. M. Kintner and G. B. Rosenblatt. 24,445. November 1st (date applied for under International Convention, November 4th, 1905).

Chains for Suspending Electrical Fittings, Particularly Electric Lamps. Verity's, Ltd., and H. S. Smith. 29,434. December 27th.

Liquid Electric Motor Starters and Controllers. J. Olive and F. Swarbrick. 7,668. March 30th.

Alternate Current Motors, Generators and Transformers. V. A. Fynn. 7,821. March 31st.

Process for Producing Compounds of Oxygen and Nitrogen by Aid of Electric Discharges. W. P. Thompson (Westdeutsche Thomasphosphat Werke Ges.) 7,829. March 31st.

Signalling Systems for Railways and the like. British Thomson-Houston Co. (General Electric Co.) 7,831. March 31st.

Methods of Supporting Collecting Rings for Dynamo-Electric Machines. British Thomson-Houston Co. and W. F. Dawson. 8,983. April 12th.

Means for Supporting the End Connections of Dynamo-Electric Machines. British Thomson-Houston Co. and W. F. Dawson. 8,984. April 12th.

Method of Electrical Detection Between Railway or Tramway Signals, Points, Facing Point Locks, or Fouling Bars. McKenzie & Holland, Ltd., and C. H. W. Edmonds. 9,786. April 26th.

Electric Telegraphy. I. Kitsee. 10,249. May 2nd.

Telephone Transmitters. H. H. Lake (Stromberg-Carlson Telephone Manufacturing Co.) 10,603. May 5th.

Electric Switches. A. Eckstein & A. C. Heap. 11,335. May 15th.

Manufacture of Electric Insulating Material. C. Hess. 11,950. May 22nd.

Machines for use in the Manufacture of Incandescent Electric Lamps. British Thomson-Houston Co. (General Electric Co.) 12,732. May 31st.

Switches for Controlling Electric Circuits. British Thomson-Houston Co. (General Electric Co.) 13,222. June 7th.

Electrical Contact Makers and Breakers and the like Particularly Applicable for use with Internal Combustion Engines. C. A. Hamilton. 13,651. June 14th.

Electricity Meters. Chamberlain & Hookham, Ltd., and S. H. Holden. 13,985. June 19th.

Suspension of Electric and other Lamps and other Articles. A. Wunderlich and G. A. Hughes. 14,041. June 19th.

Electrically Operated System of Slide Bars and Safety Bolts for securing Railway Carriage Doors. A. Taylor and E. Cressey. 14,458. June 25th.

Variable Electric Condensers. Marconi's Wireless Telegraph Co. and J. St. Vincent Pletts. 15,909. July 13th.

Electric Stop Motions of Drawing, Slubbing, Roving, and like Frames. J. T. Tweedale and Tweedales & Smalley, Ltd. 17,378. August 2nd.

Electro-Magnetic Devices for doing Work on any Restrained Body. Belliss & Morcom, Ltd., and R. MacGregor. 19,486. August 31st.

Electrical Furnaces. F. A. Kjellin. 21,416. September 27th. (Date applied for under International Convention, March 5th, 1906.)